MANAGEMENT OF TENDINOPATHIES OF THE FOOT AND THE ANKLE: GETTING ATHLETES BACK TO SPORT

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INTRODUCTION - INCIDENCE

Increasing incidence of tendinopathy because of higher participation in recreational sports → Increased risk of acute and overuse injuries
While several foot and ankle tendons may be involved, the most frequently affected structures are:

- The peroneal tendon
- The tibialis posterior tendon
- The achilles tendon
- The flexor hallucis longus

The incidence of foot injuries in the general population is 80%.
The prevalence is also high among the athletes. In runners, 40-50% of all injuries occur below the knee.

In professional soccer players, the foot and the ankle are the most common sites of injury besides the thigh.

PATHOPHYSIOLOGY

In high-impact sports involving running and jumping, a high biomechanical stress is applied on the foot. It must bear 3-4 times the body weight during running.

During physical activities, much stress and forces are focused on the tendinous aspect of the muscle-tendon unit → the risk of tendon injury rises.

The lack of muscle mass around the structures of the foot and ankle predisposes to overuse injuries, because of the low capacity to shock absorption.

The physiological response to tendon injury starts with inflammation (i.e. tendinitis), followed by accumulation and deposition of collagen matrix within the tendon. The process ends with a final tendon remodelling (i.e. tendinosis). Inflammation plays a role only during the first phases of the disease. However, if poor blood local supply or constant mechanical stress on the tendon are present, they may prevent the resolution. Many authors have stated that tendinopathies are the result of failed healing processes rather than an inflammatory condition. Repetitive strains lead tenocytes to release inflammation molecules and micro ruptures of collagen fibrils gradually develop**.** The result is a disorganized tendon matrix, characterized by hypercellularity and hypervascularization. The tendon will be weaker and unable to respond to functional demands.

RISK FACTORS

➢ Intrinsic risk factors

- Malalignement as hyperpronation or femoral neck anteversion
- Limb length discrepancy
- Muscular imbalance
- Muscular insufficiency

➢ Extrinsic risk factors

- Training errors regarding technique, intensity, distance, hill work
- Training surfaces
- Environmental conditions
- Footwear and equipement

In 2007, van Gent reported the four main risk factors for the lower-extremity injuries:

- **SYSTEMIC factors** (female sex, greater age, greater height, greater weight, greater knee varus, lower heel valgus, higher right arch index)
- **LIFESTYLE factors** (drinking alcohol, thigh and hamstring injuries in cycling and aerobics sports)
- **HEALTH factors** (history of previous injuries, positive medical history)
- **RUNNING/TRAINING factors** (running > 2 days a week, running a whole year without a break from training, training > 64 km/week, long – distance races as marathon, concrete surfaces for women, using a greater number of shoes for running)

The first step for a complete function recovery is to remove and correct any predisposing factor.

DIAGNOSTIC EVALUATION

It is possible to previously identify asymptomatic individuals who are likely to develop tendon injuries, just using ultrasonography.
Many authors have stated that tendinopathies are the result of failed healing processes rather than an inflammatory condition.

PERONEAL TENDINOPATHY

➢ Epidemiology and risk factors

- Chronic tendinitis and interstitial tears are more common than complete tear or subluxation
- Peroneal tendon dislocation occurs in 0,3-0,5% of all traumatic ankle events, especially among athletes
- The presence of a peroneus quartus muscle or a low-lying muscle belly increases the risks of tendon dislocation
- A hindfoot varus increases the forces through the peroneus brevis and the peroneus longus
- A flat foot may predispose to tendon dislocation

➢ **MECHANISM OF INJURY**

Both the peroneus brevis and longus are secondary restraints to inversion stresses. The tendon dislocation usually occurs when the peroneal muscles suddenly eccentrically contract on acute dorsiflexion of the foot, with or without inversion, or during forced dorsiflexion of the everted foot
→ the result may be a rupture of the superior peroneal retinaculum.
→ the peroneal tendons may dislocate anteriorly, over the lateral malleolus.

➢ **DIAGNOSIS:**

- Pain and swelling posterior to the lateral malleolus
- Pain during active eversion and dorsiflexion against resistance
- The patient often reports a history of chronic lateral ankle pain and joint instability
- Us and mri excellent for diagnosis
- X-rays required according to the Ottawa ankle rules

➢ **MANAGEMENT**

In case of tendon dislocation, conservative management is usually effective only in 20% of cases. The other 80% requires surgery

The peroneal tendinopathy usually responds to nonoperative treatments, as physical therapy, NSAIDS and immobilization

Orthotic inserts with lateral heel posting to offload the peroneal tendons. However, peroneal tendons are mostly active when the heel is off the ground during gait → controversial treatment

Surgery must repair the superior peroneal tunnel, formed by:
- The superior peroneal retinaculum (spr)
- The retromalleolar groove
- The dorsal intermuscular septum

Surgical techniques may be divided into 4 categories:
- Repair or reconstruction of the spr
- Groove deepening of the retromalleolar groove
- Bony procedures
- Rerouting procedures

POSTERIOR TIBIALIS TENDINOPATHY

➢ **EPIDEMIOLOGY AND RISK FACTORS**

Posterior tibialis tendon injuries are uncommon among athletes. Its dysfunction is the most common cause of acquired flatfoot in adults → the medial longitudinal arch collapses, with possible development of:
- Abduction of the forefoot
- Calcaneus valgus
- Plantar drop of the talus
- Fixed forefoot varus-supination deformity
- Hypertension, diabetes mellitus and obesity are highly correlated with posterior tibialis tendinopathy

➢ **MECHANISM OF INJURY**

Isolated traumatic dislocations of the posterior tibialis tendon are rare. Usually they occur after an inversion and dorsiflexion or plantarflexion of the ankle.
Multiple steroid injections and tarsal tunnel release are predisposing factors.

➢ **DIAGNOSIS:**

- The patient attempts to invert the foot against resistance, starting from a plantarflexion, heel eversion and forefoot abduction. The posterior tibialis is seen and palpated posterior to the medial malleolus
- Pain worsens during the weight-bearing and the inversion and plantar flexion against resistance
- The dislocated tendon may be reduced by a tibiotalar plantarflexion and it redislocates with a dorsiflexion
- A common examination finding is the “too many toes” sign
- Applying an opposed contraction of the tibialis posterior muscle, the patient may feel a painful “click”

➢ **MANAGEMENT**

DISLOCATION:

- Surgery takes place in acute setting
- PTT does not require reconstruction or repair, it is re-routed under the calcaneofibular ligament
- Retinaculum is repared, stability and mobility of the PTT are evaluated

DISRUPTION:

- Surgery takes place after conservative treatment has failed.
- A calcaneal osteotomy is indicated only in case of malalignment.
- The sheath of the PTT is opened and inspected, PTT is repaired, FDL is sutured with PTT for a tendon augmentation.
- If a pes planovalgus deformity has developed, a restoring of the medial longitudinal arch is needed, through a lengthening of the lateral column.

➢ **REHABILITATION**

Dislocation:

- Weight-bearing is discouraged for the first 3-4 postoperative weeks
- 4 weeks postop: plaster boot
- 6 weeks postop: complete weight bearing
- 12 weeks postop: sport is allowed

Disruption:

- Weight-bearing is highly discouraged for the first 3-4 postoperative weeks.
- 1 week postop: rest, ice, elevation of the foot, medications, thrombosis and pulmunary embolism prevention.
- 6 weeks postop: physical therapy may be started, for active motion and strength recovery.

FLEXOR HALLUCIS LONGUS TENDINOPATHY

➢ **EPIDEMIOLOGY AND RISK FACTORS**

- It is the most common lower extremity tendinitis among ballet dancers (because of hyper-plantar-flexed posturing) and athletes performing repetitive push-off maneuvers.
- FHL tendinitis is one cause of posterior ankle pain and/or impingement.
- An os trigonum and a hypertrophic posterior talar process contribute to the posterior ankle pain, because of an impingement between the posterior tibia and the calcaneus.
- Stenosing tenosynovitis is the most frequent example of FHL affection. Other examples are: nodule development with and without triggering, traumatic and atraumatic partial or complete tendon ruptures. These conditions are usually associated with the os trigonum syndrome.
- FHL injuries can be divided into 3 groups, according to the anatomic area:

- Distal to the sesamoids.
- Between the sesamoids and the knot of Henry.
- Proximal to the knot of Henry.

The FHL flexes the distal phalanx of the great toe. It gives the last lift-off power for walking, running and jumping

➢ **CLINICAL PRESENTATION:**

Pain and swelling over the posteromedial aspect of the joint which may radiate distally along the medial arch. Pain evoked by flexing the great toe against resistance, along the posteromedial aspect of the ankle, behind the medial malleolus or the medial area of the subtalar joint.

➢ **CLINICAL PRESENTATION AND DIAGNOSIS:**

- Passive and/or active ankle and/or hallux range of motion is painful. Crepitus or triggering of the hallux may be present.
- Plain lateral radiographs not always show the os trigonum and its relation to the talus → the CT scans give more details.
- The MRI may demonstrate thickening and tenosynovitis of the FHL.

➢ **MANAGEMENT**

- Conservative treatment is usually successful, including physical activity and corticosteroids injections into the tendon sheath.
- In case of prolonged inflammation, an immobilization for 2-3 weeks in a cast or walking boot may be recommended.
- If conservative management fails, the presence of a stenosing tenosynovitis should be considered and surgery may be required.

➢ **SURGICAL TREATMENT**

The 2-portal posterior endoscopic approach with the patient in a prone position has been first described by van Dijk.
The main endoscopic steps are:

- Debridement of soft tissue
- Identification of the FHL tendon
- Resection of the os trigonum
- Release of the tendon sheath
- Repair of the FHL tendon
- Check of the obtained tendon release

➢ **REHABILITATION**

Postoperative program:

- Ankle immobilization and partial weight-bearing for 3-5 days
- Full weight-bearing 5 days after surgery
- Range of motion exercises start 1 week postop
- Muscle-strengthening and proprioception exercises are allowed 2 weeks postop

Prevention includes:

- Reducing the turnout of the hip
- Strengthening the body's core
- Avoiding hard floors
- Using firm, well-fitted shoes

TIBIALIS ANTERIOR TENDINOPATHY

➢ **EPIDEMIOLOGY AND RISK FACTORS**

- Anterior tibial injury usually occurs as a chronic overuse lesion in patients older than 45 years
- It is also frequent among distance runners, walkers and soccer players, after a forced dorsiflexion of a plantar flexed foot against resistance → eccentric stress on the muscle.

➢ **CLINICAL PRESENTATION AND DIAGNOSIS:**

- Pain over the anterior aspect of the ankle
- Weak dorsiflexion of the foot
- In addition to tenderness, palpation may identify a tender thickening on the peritendon, associated with a crepitus during plantar and dorsiflexion.

➢ **MANAGEMENT**

- Immobilization for 3 weeks
- Deambulation with a brace for 3 weeks
- The use of us-guided steroid injections into the tendon sheath for severe tenosynovitis or bursitis has been described as effective.
- A tendon rupture is rare. If present, surgery is required → primary repair, tendon grafts, tendon transfers and tendon reconstruction.

Main goals for a satisfying recovery of chronic tendinopathies:

1) Stimulating healing processes
- Prolotherapy
- PRP injections

2) Obliterating the neo-vessels
- Sclerotherapy
- High-volume injections

Despite the several treatment options, tendinopathies still have a poor prognosis, with high incidence of chronicity. Although, most of the tendon ruptures occur without warning symptoms, the injuried tendons frequently present degenerative changes→ early treatment and prevention are recommended

➢ **REHABILITATION**

Rehabilitation protocols depend on the single clinical Case based on information such as the site, the quality and the severity of the injury. The clinician must:

- Identify the injury
- Grade the severity
- Create a multidisciplinar protocol

- Modify risk factors

RETURN TO SPORT

To prepare the athlete for the returning to sport, the rehabilitation should focus on:

- Increasing strength
- Improving endurance and technical ability
- Correcting focal overload
- Premature return to sport may lead to further injuries. At the same time, prolonged inactivity may cause physical deconditioning.

To decide if the athlete is ready for sports activity, general guidelines include:

- ✓ Full and pain-free range of motion
- ✓ Strength recovery of at least 90%
- ✓ Pre-injury recovery of balance and proprioception
- ✓ Awareness of the risks of re-injury and how to prevent it.

Example of a protocol model for returning to track and field activity:

1. Acute phase: immobilization of the ankle to normalize the gait
2. Range of motion phase: a pain-free range of motion must be regained, starting with concentric and progressing to eccentric training
3. Functional phase: establishes the limb loading and the return to running activities, agility drills and plyometric training
4. Return-to-play phase: achieved after a variable time, according to the severity of injury and the athlete's response to the protocol

PREVENTION STRATEGIES

The interventions should focus on four main categories:

- Stretching and conditioning exercises
- Modification of training schedules
- Use of orthoses
- Attention to potential external risk factors and footwear

CONCLUSIONS

- Tendinopathies of the foot and ankle require an accurate management.
- Prevention is paramount to avoid the development of chronicity.
- Tendinopathies of the foot and ankle may compromise an athlete's carreer→ correction of risk factors is fundamental.
- Therapies promoting "healing processes" are useful.
- Return-to-play must respect biological times.
- Recovering a correct motor ability and endhurance is primary.