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Achilles Tendinopathy in Athletes: Risk, Factors, Diagnosis, Treatment and Prevention. A Perspective of Recent Literature

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Abstract

Background: Achilles tendinopathy is a common overuse disorder affecting athletes and physically active individuals. It is characterized by tendon pain, morning stiffness, and reduced ability to tolerate sport-specific loading. Due to its multifactorial nature, both effective management and prevention remain clinically challenging.

Aim: To summarize current evidence on risk factors, diagnosis, treatment, and prevention of Achilles tendinopathy in athletes.

Methods: A targeted literature search was conducted in PubMed, PubMed Central, and NCBI resources. Clinical practice guidelines, systematic reviews, randomized trials, cohort studies, and landmark conceptual papers were prioritized and narratively analyzed.

Results: The available evidence indicates that Achilles tendinopathy is influenced by previous tendon symptoms, sudden changes in training load, calf-muscle capacity, biomechanical factors, age, body composition, metabolic profile, and sport-specific demands. Diagnosis remains primarily clinical and should distinguish midportion from insertional tendinopathy. Imaging is most useful when symptoms are atypical, severe, or refractory. Progressive tendon loading is the core treatment strategy and should be supported by patient education, pain monitoring, and gradual return to sport. Adjunctive interventions may be considered selectively, although evidence for many passive modalities remains inconsistent.

Conclusions: Achilles tendinopathy in athletes requires an individualized approach focused on load management and restoration of tendon capacity. Prevention should emphasize progressive strengthening, monitoring of recurrent symptoms, and modification of relevant extrinsic risk factors.

Keywords: Achilles tendinopathy; athlete; diagnosis; eccentric exercise; rehabilitation; prevention; return to sport.

Introduction

Achilles tendinopathy is a common tendon disorder in sport and exercise medicine. It usually presents as pain localized to the Achilles tendon, stiffness after rest and reduced tolerance to running, jumping, sprinting or other activities that require repeated storage and release of elastic energy. The condition is clinically relevant not only because it limits performance, but also because symptoms may become persistent, relapse during return to sport and interfere with training availability across an entire season. Although the term tendinitis is still used in everyday language, the dominant modern concept describes a load-related tendinopathy rather than a simple inflammatory lesion [1-3].

The Achilles tendon transfers force from the gastrocnemius-soleus complex to the calcaneus and is exposed to very high loads during locomotion. Running and jumping can subject the tendon to repeated tensile and compressive demands, especially when training volume, intensity or terrain changes faster than the athlete can adapt. This explains why the disorder is particularly relevant in endurance running, track and field, football, basketball, volleyball, gymnastics, racket sports and military-style training. At the same time, Achilles tendinopathy also appears in non-elite recreational athletes, making it an important public health and sport participation problem [4-8].

Clinically, Achilles tendinopathy is often divided into midportion and insertional forms. Midportion tendinopathy typically involves the tendon body approximately 2-6 cm proximal to the calcaneal insertion, whereas insertional tendinopathy occurs at or close to the calcaneal attachment and may coexist with retrocalcaneal bursitis, Haglund-related irritation or calcific change. This distinction matters because prognosis, loading tolerance and exercise selection differ. For example, exercises that place the ankle into high dorsiflexion may be appropriate in some midportion cases but provocative in insertional symptoms because of increased compression at the calcaneal insertion [1-2].

The aim of this narrative review is to synthesize PubMed/NCBI-indexed literature on Achilles tendinopathy in athletes, with emphasis on risk factors, diagnosis, treatment and prevention. The review is written as a practical scientific overview for clinicians, coaches and sport professionals, while retaining the structure and reference style expected in a journal manuscript.

Material and methods

This manuscript is a narrative review. A targeted literature search was performed in PubMed, PubMed Central and NCBI Bookshelf using combinations of the terms: Achilles tendinopathy, Achilles tendon, athlete, runner, risk factor, epidemiology, diagnosis, ultrasound, MRI, VISA-A, eccentric exercise, heavy slow resistance, shockwave, platelet-rich plasma, return to sport and prevention. Priority was given to clinical practice guidelines, systematic reviews, randomized controlled trials, prospective cohort studies and widely cited conceptual articles that are directly relevant to sports medicine.

Because the aim was to provide a broad clinical synthesis rather than a formal systematic review, no meta-analysis was performed and the risk of bias of each study was not independently scored. The included literature was interpreted narratively and grouped into four main domains: risk factors, diagnosis, treatment and prevention. Landmark papers were retained when they explained current concepts of tendon pathology or shaped clinical management, even if newer studies were also available. The final reference list includes more than 30 peer-reviewed publications, with emphasis on sources indexed in PubMed or available through NCBI/PMC.

Table 1. Selected key sources used in this narrative synthesis.

Evidence type	Examples of included sources	Relevance to the review
Clinical guidelines	Dutch multidisciplinary guideline; 2024 JOSPT clinical practice guideline [1,3]	Defines diagnostic pathway, load-based care and evidence-informed recommendations.
Conceptual pathology papers	Cook and Purdam continuum model and later clinical revision [5,6]	Explains why symptoms and structural imaging changes do not always move together.
Epidemiology and cohort studies	General population incidence, elite athlete data and runner cohorts [7-11]	Quantifies burden, subtypes and recurrent-risk patterns.
Risk factor reviews	Systematic reviews and expert Delphi studies [12-14]	Summarizes intrinsic, extrinsic and biomedical risk factors.
Diagnosis papers	Clinical diagnosis review, VISA-A validation and imaging studies [15-18]	Supports clinical examination, patient-reported outcomes and selective imaging.
Treatment trials and reviews	Exercise, shockwave, PRP and network meta-analyses [19-29]	Clarifies first-line treatment and cautions against poorly supported injections.
Prevention and return-to-sport literature	Preventive exercise, balance training, footwear/foot strike and RTS criteria [30-34]	Provides practical sport-specific prevention and progression principles.

Results

Anatomy and pathophysiological concepts

The Achilles tendon is formed by the gastrocnemius and soleus aponeuroses and inserts into the posterior calcaneus. Its mechanical role is not limited to transmitting muscle force; it stores and releases elastic energy during running and jumping. This spring-like function improves locomotor efficiency but also exposes the tendon to repeated high strain. The midportion of the tendon has a relatively vulnerable region a few centimetres above the insertion, while the insertional region is exposed to combined tensile and compressive loading against the calcaneus during dorsiflexion [1,4].

Tendinopathy is best understood as a failed or insufficient adaptation to load rather than a single acute inflammatory event. The continuum model proposes that tendon tissue can move between reactive change, tendon disrepair and degenerative pathology depending on load exposure, recovery and individual capacity. In clinical practice, this model helps explain why an athlete may develop pain after a sudden spike in speed work, hills, plyometrics or competition density, even when no complete structural failure is present. It also explains why treatment should not focus only on suppressing symptoms but on restoring load tolerance [5-6].

Histological and imaging studies in chronic tendinopathy describe collagen disorganization, increased ground substance, altered tenocyte activity, neovascularization and variable structural thickening. However, structural abnormalities are not identical with pain. Some asymptomatic athletes show tendon thickening or imaging changes, while some painful tendons display only modest structural findings. Therefore, imaging should support the clinical picture rather than replace it. This principle is especially important in athletes, where overdiagnosis based on imaging alone may lead to unnecessary rest or fear of loading [1-2,9].

Pain mechanisms are also multifactorial. Local tendon tissue changes, peritendinous irritation, altered calf muscle function, central pain modulation and psychological factors may all contribute to the final clinical presentation. The persistence of symptoms is often related to a cycle in which pain reduces calf capacity, reduced capacity lowers tolerance to training, and repeated attempts to return too quickly reproduce symptoms. A modern rehabilitation approach therefore combines symptom education, progressive loading, monitoring and sport-specific reconditioning [2-3].

Epidemiology and burden in athletes

Achilles tendinopathy occurs across a wide spectrum of sport participation. A meta-analysis on physical exercise reported an overall Achilles tendinopathy prevalence of about 6%, with higher estimates in some sport categories and in older participants [7]. General population data indicate that midportion Achilles tendinopathy is not limited to professional sport, but its occurrence is amplified in individuals exposed to repetitive running and jumping loads [8].

Historical data from former elite male athletes show that some sports carry particularly high lifetime burdens. Middle- and long-distance runners had markedly greater odds of Achilles tendinopathy than non-athlete controls, while sprinters were especially represented in Achilles tendon rupture data [10]. These observations are clinically plausible: distance running emphasizes repeated submaximal tendon loading, whereas sprinting imposes high peak loads and rapid stretch-shortening-cycle demands.

Prospective running cohorts provide information that is directly applicable to contemporary recreational athletes. In one large cohort, new Achilles tendinopathy developed in roughly one out of twenty runners during follow-up, and a history of Achilles symptoms was the clearest predictor of a subsequent episode [11]. Another prospective study reported a 4.2% incidence of new-onset Achilles tendinopathy, with midportion symptoms accounting for most cases and insertional symptoms representing a smaller but clinically important subgroup [12]. These findings show that Achilles tendinopathy is common enough to require active monitoring and that recurrence history should be treated as a major clinical warning sign.

The burden is not captured only by prevalence. Athletes may continue training with pain for weeks or months, which can obscure time-loss statistics. Symptoms may fluctuate: a player can tolerate low-volume training but fail during congested competition, high-speed running or

maximal jumping. From a quality-in-sport perspective, this condition affects availability, load planning, performance confidence and long-term participation.

Risk factors in athletes

Risk factors for Achilles tendinopathy should be interpreted as interacting contributors rather than isolated causes. Systematic reviews show that the evidence is uneven: some factors are repeatedly observed, but many studies differ in definitions, populations and follow-up duration [13-14]. Expert consensus also emphasizes the multifactorial nature of the disorder, combining local tendon capacity, training load, biomechanical exposure, previous injury and systemic influences [15].

The most consistent clinical risk factor is previous Achilles tendinopathy. In prospective runner cohorts, symptoms in the preceding 12 months markedly increased the odds of new symptoms [11-12]. This is important for screening and prevention because a previous episode may indicate persistent deficits in calf strength, tendon stiffness, neuromuscular control or load-management habits. Athletes who report a history of morning stiffness or tendon pain after training should not be treated as identical to those with no previous symptoms.

Training-load error is a central extrinsic contributor. Rapid increases in running volume, intensity, hill work, speed sessions, plyometrics or match exposure may exceed the tendon capacity that has been developed in the preceding weeks. Conversely, abrupt reductions followed by rapid return, such as after illness, holiday, off-season or immobilization, may create a mismatch between desired performance and actual tissue preparedness. This concept supports gradual progression, especially when athletes shift from base training to high-speed or competition-specific work.

Biomechanical factors may influence the distribution of tendon load. Reduced plantarflexor strength or endurance, limited ankle dorsiflexion, altered foot posture, excessive pronation or supination, hip and knee control deficits, and running mechanics have all been discussed as possible contributors. However, evidence for single biomechanical predictors is not strong enough to justify one universal correction strategy for all athletes. A more useful approach is individualized assessment: identify movement or strength deficits that are present in a specific athlete and connect them to symptoms and sport demands [13-15].

Age and body composition may also play a role. Tendon adaptation is slower than muscle adaptation, and older athletes may have cumulative tendon exposure, altered collagen turnover or coexisting metabolic factors. Reviews of biomedical risk factors suggest that higher body mass index and adverse lipid profile may be associated with Achilles tendinopathy, although causality remains difficult to prove [14]. In athletes, body composition must be interpreted carefully; high body mass can represent either adiposity or sport-specific muscle mass, but both may increase tendon loading during running and jumping.

Medication and systemic health should be considered during history taking. Fluoroquinolone exposure is a recognized risk factor for tendon symptoms and rupture, especially when combined with corticosteroid use or other vulnerability factors. Endocrine and metabolic conditions, including diabetes and dyslipidemia, may also influence tendon health. Although many athletic populations are young and healthy, clinicians should not ignore systemic contributors when symptoms are bilateral, recurrent, disproportionate or resistant to appropriate rehabilitation [13-14].

Sport-specific context modifies risk. Runners often face cumulative load, footwear transition, terrain changes and race preparation cycles. Court and field athletes experience repeated accelerations, decelerations and jumps. Gymnasts and dancers expose the tendon to high elastic and sometimes end-range loads. Team-sport athletes may have a mismatch between gym-based strength and the chaotic tendon demands of competition. Therefore, prevention and rehabilitation should be designed around the actual load profile of the sport, not only around generic calf exercises.

Table 2. Practical risk-factor framework for athletes with Achilles tendinopathy.

Domain	Examples	Clinical meaning
Previous symptoms	Achilles pain, morning stiffness, prior time-loss episode	Strong warning sign; requires slower progression and monitoring during return to sport.
Training load	Sudden increase in mileage, hills, sprinting, plyometrics, congested competition	Most modifiable domain; compare recent workload with previous 4-8 weeks.
Capacity deficits	Low calf strength or endurance, side-to-side asymmetry, reduced hopping tolerance	Progressive strengthening and plyometric reconditioning should be individualized.
Biomechanics	Running mechanics, ankle mobility, foot posture, hip-knee control	Assess only when relevant to symptoms; avoid one-size-fits-all correction.
Systemic factors	Age, high BMI, dyslipidemia, diabetes, fluoroquinolone exposure	Important in recurrent, bilateral or atypical cases; may influence prognosis.
Equipment and environment	Footwear transition, minimalist shoes, hard surfaces, cambered roads	Modify temporarily when symptoms flare; reintroduce gradually when capacity improves.
Recovery and context	Sleep restriction, travel, reduced recovery, off-season return	May lower tissue tolerance even without a clear training spike.

Diagnosis

Diagnosis is primarily clinical. The typical presentation includes localized tendon pain, morning stiffness or stiffness after sitting, pain at the beginning of activity that may warm up temporarily, and discomfort after loading. Midportion symptoms are usually localized 2-6 cm above the calcaneal insertion, while insertional symptoms are closer to the heel attachment. The history should identify the onset pattern, sport demands, recent load changes, prior Achilles symptoms, systemic risk factors, medication exposure and previous treatment [1-2,16-17].

Physical examination should include inspection, palpation, functional loading and comparison with the opposite side. Palpation helps locate the symptomatic region and detect focal thickening. The painful arc sign and Royal London Hospital test have historically been used in

clinical assessment, although no single test should be interpreted in isolation [16-17]. Functional testing should examine calf raises, hopping, single-leg loading, walking, running progression and sport-specific tasks when appropriate. Pain during these tests should be recorded together with quality of movement and capacity.

Patient-reported outcome measures are useful for documenting baseline severity and response to treatment. The VISA-A is a validated patient-reported instrument that quantifies pain, functional limitation and activity restriction related to Achilles tendinopathy [18]. In athletes, it should not be interpreted as the only return-to-sport criterion, but it provides a practical baseline and follow-up measure that can be combined with strength, endurance, hopping and sport-specific tests.

Imaging is not routinely required when history and examination are typical, but it is useful when the diagnosis is uncertain, symptoms are severe, there is suspicion of partial tear or rupture, or the athlete fails to improve despite appropriate rehabilitation. Ultrasound is accessible, dynamic and useful for tendon thickness, structural disorganization, neovascularity and differential diagnosis. MRI provides detailed assessment of tendon and surrounding structures and may be useful in insertional disease, complex cases or surgical planning. Both modalities can identify abnormalities in asymptomatic tendons; therefore, imaging findings must be interpreted in context [1,9].

Differential diagnosis is essential. Posterior ankle pain may reflect paratenon irritation, retrocalcaneal bursitis, Haglund-related compression, plantaris-related pain, flexor hallucis longus disorder, posterior ankle impingement, sural nerve irritation, calcaneal stress injury, inflammatory enthesitis or referred pain. Complete Achilles rupture requires urgent recognition and is suggested by sudden pain, a gap, weakness and a positive Thompson test. In ambiguous cases, imaging and specialist evaluation are warranted.

Table 3. Diagnostic approach and common differential diagnoses.

Step	What to assess	Practical interpretation
History	Pain location, morning stiffness, warm-up effect, load change, prior symptoms	Typical symptoms support clinical diagnosis; recurrence history changes prognosis.
Palpation	Midportion vs insertional tenderness, nodular thickening, paratenon irritation	Location guides exercise selection and compression management.
Functional tests	Single-leg calf raise, hopping, running, sport-specific loading	Capacity and symptom response are more useful than pain alone.
Patient-reported outcome	VISA-A or similar symptom/function scale	Provides baseline and follow-up measurement.
Imaging	Ultrasound or MRI when atypical, severe, refractory or preoperative	Use to support diagnosis; avoid treating imaging abnormalities without symptoms.
Differential diagnosis	Rupture, bursitis, plantaris involvement, posterior impingement, stress fracture, inflammatory enthesitis	Red flags or atypical symptoms require further assessment.

Treatment

The cornerstone of treatment is progressive tendon loading. Contemporary guidelines and reviews support exercise-based rehabilitation as first-line care, combined with education, load management and gradual restoration of function [1-3]. Complete rest is rarely an ideal long-term solution because it may reduce pain temporarily while further decreasing the tendon and calf capacity needed for return to sport. The goal is not simply to silence pain for a few days, but to rebuild tolerance to the loads that the athlete must perform.

Education begins with explaining the condition and establishing expectations. Achilles tendinopathy often improves slowly, and meaningful recovery may require months rather than days. Athletes should understand that some pain during rehabilitation can be acceptable if symptoms remain controlled and do not worsen progressively from week to week. Pain-monitoring models allow activity when pain is mild to moderate and settles within an acceptable period, but the exact threshold should be individualized according to irritability, sport level and clinical response [2,19].

Load modification should be precise rather than vague. In the reactive or irritable phase, it may be necessary to reduce high tendon-energy-storage activities such as sprinting, jumping, hill running and rapid direction change, while maintaining fitness through cycling, swimming, anti-gravity running or modified gym work when tolerated. As symptoms stabilize, progressive calf loading is introduced and then expanded toward plyometrics, running drills and full sport participation. This staged logic helps avoid the common mistake of performing strengthening exercises while simultaneously keeping the same provocative sport load.

Eccentric calf training has a strong historical role, especially the Alfredson heel-drop protocol for chronic midportion tendinopathy [20]. Long-term follow-up data indicate that many patients report sustained improvement after structured heel-drop loading, although not all athletes respond equally and some require additional or alternative strategies [21]. Later research shows that heavy slow resistance training can achieve comparable clinical improvements and may have better patient acceptability in some settings [22]. The practical implication is that eccentric loading is not the only valid method. The program should be selected according to symptom irritability, insertional versus midportion location, equipment, athlete preference and the need to progress toward sport-specific function.

Exercise progression usually begins with isometric or isotonic calf loading if symptoms are irritable, then moves toward heavier resistance, slower controlled work, endurance loading and finally energy-storage tasks. Soleus loading is important because the soleus contributes substantially during running and must be trained with bent-knee variations. For insertional tendinopathy, deep dorsiflexion positions may need to be limited initially to reduce compressive load at the insertion. For midportion tendinopathy, heel drops below step level may be appropriate later if tolerated, but they are not mandatory for all athletes [1-3].

Exercise-based rehabilitation remains the main active treatment across most evidence syntheses, but comparative reviews also show that the relative ranking of nonsurgical options is affected by study quality, diagnostic subgroup and outcome timing [23-24]. Shockwave therapy has been studied as an adjunct, with trials suggesting benefit in selected patients, particularly when combined with eccentric loading or when exercise alone has not produced sufficient improvement [25-27]. However, it should not replace a loading program. Passive modalities such as massage, ultrasound therapy or short-term anti-inflammatory medication may reduce symptoms in some cases, but they do not restore tendon capacity by themselves. Their role should be supportive and time-limited rather than central.

Injection therapies require caution. Early enthusiasm for platelet-rich plasma has not been supported consistently by high-quality trials. A randomized controlled trial found that platelet-rich plasma added to eccentric training was not superior to saline injection, and later follow-up did not show a clear advantage [28-29]. A large JAMA randomized clinical trial also found no meaningful benefit of a single intratendinous PRP injection compared with sham injection for chronic midportion Achilles tendinopathy [30]. Corticosteroid injections around the Achilles region are also approached cautiously because of concerns about tendon weakening, especially if injected intratendinously. If injections are considered, they should be reserved for carefully selected cases and not substitute for rehabilitation.

Surgery is generally reserved for persistent cases that fail a substantial period of high-quality conservative treatment. Surgical options vary and may include debridement, plantaris-related procedures, paratenon procedures or insertional decompression depending on pathology and location. A systematic review suggests that surgical treatment can help selected patients, but study heterogeneity and postoperative recovery time require careful counselling [31]. Athletes should be informed that surgery is not a quick performance fix and still requires structured rehabilitation and return-to-sport progression.

Table 4. Treatment options and evidence-informed practical use.

Intervention	Typical role	Important cautions
Education and load management	Foundation of care; reduces mismatch between tendon capacity and sport demand	Avoid unspecific advice such as rest only; identify exact provocative loads.
Progressive calf strengthening	First-line treatment; eccentric or heavy slow resistance approaches may be used	Progression must include soleus work and later energy-storage tasks.
Plyometric and running progression	Required for athletes returning to sprinting, jumping or match play	Introduce only after sufficient strength and symptom stability.
Shockwave therapy	Adjunct for selected chronic cases or insufficient response to exercise	Should not replace loading rehabilitation.
PRP injection	Not recommended as routine first-line treatment for chronic midportion tendinopathy	Large RCTs do not show clear clinically meaningful superiority over sham/saline.
Medication	Short-term symptom relief in selected cases	Does not restore tendon capacity; consider systemic risks.
Surgery	Option after prolonged failed conservative treatment and clear indication	Recovery is lengthy; evidence is heterogeneous; requires postoperative rehabilitation.

Return to sport

Return to sport after Achilles tendinopathy should be criteria-based rather than based only on time. Athletes often feel better during daily activities before the tendon can tolerate high-speed running, repeated jumping or full match exposure. A premature return may create a cycle of flare-ups and reduced confidence. Reviews of return-to-sport literature show that definitions and criteria are inconsistent, which makes clinical reasoning and transparent communication essential [32].

A useful return-to-sport framework includes symptom stability, calf strength and endurance, hopping and plyometric tolerance, sport-specific progression and next-day response. The athlete should demonstrate improving or acceptable VISA-A score, pain that remains within agreed limits, no progressive morning stiffness, and the ability to complete relevant training tasks without delayed worsening. For running athletes, progression can move from walking and easy running to intervals, hills, tempo work and race-specific sessions. For team-sport athletes, the sequence should include acceleration, deceleration, cutting, jumping, repeated sprint exposure and controlled contact or match simulation [19].

Return to competition is not identical to return to training. Competition adds fatigue, psychological stress, unpredictability and higher peak loads. Therefore, a player may need several symptom-stable training exposures before match minutes are increased. Coaches and medical staff should agree on objective markers and monitoring rules. The key clinical question is not whether the tendon is completely pain-free on one day, but whether the athlete can absorb repeated sport loads while symptoms remain stable over the following 24-48 hours.

Prevention

Prevention of Achilles tendinopathy is based on managing the relationship between load and capacity. There is no single proven prevention protocol that eliminates risk in all sports, but several principles are supported by the broader evidence. Athletes with previous Achilles symptoms should be monitored more closely, especially during preseason, footwear transitions, rapid increases in running load and periods of congested competition [11-15].

Progressive strengthening is a logical preventive strategy because plantarflexor capacity influences the ability to tolerate repeated running and jumping. Preventive programs should include both gastrocnemius and soleus loading, unilateral strength, endurance and eventually elastic energy-storage tasks. Balance and neuromuscular training may reduce lower-limb overuse problems in some sport settings, and one soccer-specific study suggested benefit for tendon-related injuries when a structured balance program was implemented over time [33-34]. Training-load planning should avoid abrupt spikes. Weekly mileage, high-speed running, hills, jumping volume and match minutes should be progressed gradually, particularly after off-season, injury, illness or travel. The same absolute load may be safe for one athlete and excessive for another depending on previous exposure, strength, recovery, age and symptom history. Simple monitoring tools such as session rating of perceived exertion, pain maps,

morning stiffness logs and calf capacity tests can help detect early deterioration before a major flare.

Footwear and running technique deserve careful, individualized attention. Transitioning toward forefoot striking, barefoot running or minimalist footwear may increase Achilles tendon loading, particularly when the change is abrupt or introduced during periods of high training demand [35]. This does not mean that minimalist footwear or forefoot striking is universally harmful, but it does mean that technical and shoe changes should be introduced gradually and monitored. Athletes who develop symptoms soon after shoe change, terrain change or technique modification should consider reversing or slowing the transition.

Prevention also requires cultural change. Athletes often normalize morning stiffness and train through early tendon symptoms until pain becomes persistent. Coaches and clinicians should frame early reporting as performance protection, not weakness. A tendon that is managed early may require a short load adjustment, whereas a tendon ignored for months may need a long rehabilitation block. In this sense, Achilles tendinopathy prevention is part of overall quality in sport: it protects training continuity, athlete availability and long-term participation.

Discussion

The literature supports several practical conclusions. First, Achilles tendinopathy is best viewed as a load-related condition with biological, mechanical and contextual contributors. Second, the diagnosis is usually clinical and must identify symptom location, irritability and functional limitation. Third, exercise-based loading is the central treatment, while passive modalities and injections should be considered adjunctive or selective rather than foundational. Fourth, prevention and return to sport require ongoing monitoring because previous symptoms strongly predict future symptoms.

For athletes, the main challenge is not knowing that loading is useful, but choosing the correct dose. Underloading can reduce capacity, whereas overloading can provoke symptoms. This makes rehabilitation a dynamic process. The program should be reassessed regularly, using pain response, next-day stiffness, calf strength, hopping ability and sport-specific tolerance. A well-designed plan gradually narrows the gap between what the tendon can tolerate and what the sport demands.

The evidence base has limitations. Many studies use different diagnostic definitions, combine midportion and insertional cases, or involve recreational rather than elite athletes. Return-to-sport criteria are inconsistently reported. Imaging findings remain difficult to interpret because asymptomatic abnormalities are common. There is also a need for better prevention trials in specific sports and for research that integrates workload data, tendon capacity, biomechanics and systemic health. Despite these gaps, current evidence is sufficient to guide practical, individualized care.

Practical implications for sport quality

In practice, Achilles tendinopathy should be managed as a performance and availability problem, not only as a local tendon diagnosis. A club, clinic or training group can improve quality of care by implementing early symptom screening, documenting previous tendon problems, controlling rapid load changes and ensuring that rehabilitation continues beyond pain

reduction into sport-specific loading. Such an approach may reduce recurrence and help athletes return with confidence rather than with unresolved vulnerability.

A simple clinical pathway can include: (1) identify tendon location and irritability; (2) reduce the most provocative tendon-energy-storage loads temporarily; (3) start progressive calf loading; (4) restore soleus and gastrocnemius strength; (5) add plyometrics and running or jumping progressions; (6) monitor next-day response; and (7) return to training and competition using objective criteria. This pathway is consistent with contemporary recommendations and is practical for both recreational and competitive athletes.

Conclusions

Achilles tendinopathy in athletes is a multifactorial overuse condition that commonly affects running and jumping performance. The strongest clinical warning sign is previous Achilles symptoms, while training-load changes, calf capacity deficits, biomechanical exposure and systemic factors may all contribute. Diagnosis should remain clinically driven and should distinguish midportion from insertional tendinopathy. Imaging is most useful when symptoms are atypical, severe or refractory.

Progressive tendon loading, education and load management are the foundation of treatment. Eccentric exercise and heavy slow resistance are both viable loading strategies when selected and progressed appropriately. Adjunctive treatments such as shockwave therapy may help selected cases, but injections, including platelet-rich plasma, should not be used routinely as first-line care because high-quality trials have not shown consistent superiority. Return to sport should be criteria-based and should include strength, endurance, energy-storage capacity and symptom response after sport-specific exposure.

Prevention depends on matching training demands to individual tendon capacity. Monitoring previous symptoms, progressing high-load activities gradually, maintaining calf strength and introducing footwear or technique changes cautiously are central strategies. Future research should refine sport-specific prevention and return-to-sport criteria, especially for elite athletes and recurrent cases.

Disclosure

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