


Tendinopathy and Sports

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Goals and Objectives

- Review how tendon injury affects sports participation
- Challenge the concept of using pain and symptoms as the sole outcome for determining the ability to return to play
- Promote treating minor symptoms of tendinopathy early with "load control" instead of ignoring or just treating the symptoms
- Consider changes in sports performance as a possible sign of tendon overuse
- Describe a Return to Play program for Achilles Tendinopathy that also can be used as a guideline for other tendinopathies

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Return to Play - Tendinopathy

- What is the goal of treatment?
– Having no symptoms or return to previous performance level

ORIGINAL ARTICLE

Full symptom muscle-tendon

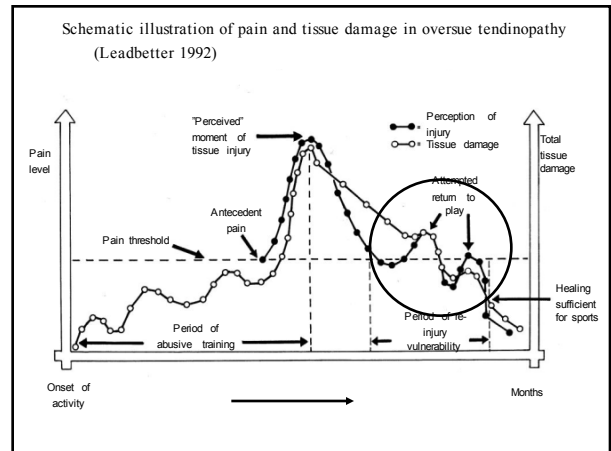
[RESEARCH REPORT] JOSPT 2008

D. S. BLAISE WILLIAMS III, PT, PhD* • JAMES A. ZAMBARINO, MPT† • VALERIE A. BANNING, DPT*

Karin Grävare Silbernagel




Transverse-Plane Mechanics at the Knee and Tibia in Runners With and Without a History of Achilles Tendinopathy

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Tendon's importance for athletic performance

- The tendon saves energy
- The tendon improves explosive performance
- Sports utilize the tendon to improve performance






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Tendon injury and performance

Pain

- The main symptom
- Experimental Achilles tendon pain causes changes in motor response (Henriksen et al. BJSM 2001)
- Indications of nervous system sensitization in persistent tendinopathies (Plinsinga et al. JOSPT 2015)



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Tendon injury and performance

Changes in mechanical properties and performance

In Symptomatic subjects

- Tendinopathic tendons has lower tendon stiffness and elastic modulus (Arya et al JAP 2010, Child et al AJSM 2010)
- Altered Achilles tendon viscoelastic properties affect explosive performance in athletes (Wang et al SJMS 2012)
- Altered stretch-shortening cycle behavior during submaximal hopping (Debenham et al JSMS 2014)
- Triceps surae activation is altered in runners with Achilles tendinopathy (Wyndow et al. JEK 2013)

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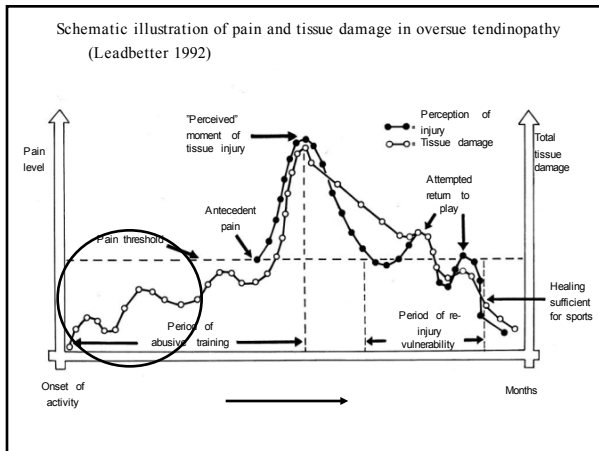
Tendon injury and performance

Changes in mechanical properties and performance

In Asymptomatic subjects (tendinosis and previous tendinopathy)

- Asymptomatic runners (previous Achilles tendinopathy) exhibit changes in knee kinetics during running, indicating permanent changes in knee biomechanics (Williams et al JOSPT 2008)
- Achilles tendinosis result in a more compliant tendon (Chang & Kulig 2015)
- The compliant tendon elicit a series of neuromechanical adaptations (Chang & Kulig J Physiol 2015)

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The problem starts before the “injury”

- Insidious onset – listen to early symptoms indications
- Training errors contributing in 60-80% of those with Achilles tendinopathy (Järvinen et al. 2005, Kvist 1991)
- Greater mileage and running years in injured runners (Haglund-Åkerlind et al. 1993)

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Athletes balance on the edge of overuse to perform at an ultimate level



Treat “minor” symptoms of tendinopathy early with “load control” instead of ignoring or just treating the symptoms.

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Change in performance could be early indication of tendon overuse




Elite Athletes

- Are they perpetual tendon over-loaders?
- Low levels of pain related fear?

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Tendon injury and performance

ORIGINAL ARTICLE

Full symptomatic recovery does not ensure full recovery of muscle-tendon function in patients with Achilles tendinopathy

Karin Grävare Silberman, Roland Thomeé, Bengt I Eriksson, Jon Karlsson

Br J Sports Med 2007;41:1-5. doi: 10.1136/bjsm.2006.033464

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Tendon injury and performance

Pilot data

- Mechanical properties evaluated with elastography in patients with Achilles tendinopathy
- Total work done on the heel rise test correlated significantly with the shear modulus on the symptomatic side ($r=0.78$)

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Return to Play - Tendinopathy

Irrespective of treatment path or injury we end up with the same question

- How do we most efficiently Return an Athlete to Play?
 - How quickly should the athlete return?
 - For how long should the athlete be able to participate?
 - Performance state?
 - Symptomatic state?

What is success?

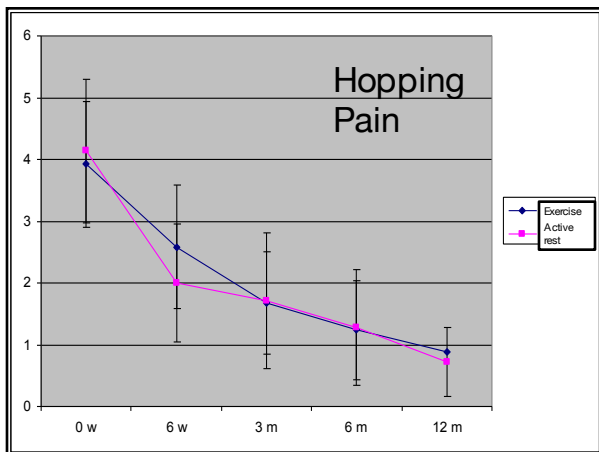
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Achilles tendinopathy

Reinjury/Recurrence Rates

- Return to sports after 12 weeks of treatment – 10-86% (Magnussen et al. 2009)
- Return to sport at 1 year – 55-99%
- Reinjury rates of Achilles tendinopathy in football players 27-44% (Gajhede-Knudsen et al BJSM 2013, Hägglund et al. AJSM 2007)
- Recurrence common and reinjury risk high in elite football players with short recovery periods (Gajhede-Knudsen et al. BJSM 2013)

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Continued sports participation

- No improvements in symptoms from the patellar tendon with eccentric exercise during the season for elite volleyball players

(Visnes et al 2005)

Time (weeks)	Control group (Mean VISA)	Training group (Mean VISA)
Pre	~65	~65
1	~75	~75
4	~75	~75
8	~75	~75
12	~75	~75
18	~75	~75
40	~75	~75

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[CLINICAL COMMENTARY]

KARIN GRÄNARE SILBERNAGEL, PT, ATC, PhD¹ • KAY M. CROSSLEY, BAppSc (Physio), PhD²

A Proposed Return-to-Sport Program for Patients With Midportion Achilles Tendinopathy: Rationale and Implementation

JOSPT November 2015
Tendinopathy Special Issue

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Return-to-Sport Program – Achilles Tendinopathy

Factors to consider when planning return to sports

- Tendon healing
- Tendon recovery
- Pain and Symptoms
- Impairments
- Load on the Achilles tendon
- Perceived rate of exertion

Silbernagel & Crossley JOSPT 2015

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Tendon Healing

- Consider what stage of tendon injury-healing the athlete is in
- Full tendon healing can take up to 12 months (Kannus et al. SJMSS 1997)
- Mechanical loading is needed for tendon healing (Kjaer 2004, Kjaer et al. 2005)
- Age, hormonal levels, medication and genetics affect healing

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Tendon recovery

Magnusson SP, Lanberg H, Kjaer M. Nat. Rev. Rheumatol. 6. 262-268 (2010)

Figure 2 Schematic representation of collagen synthesis and degradation. Acute exercise in humans is followed by an increase in both the synthesis and degradation of collagen. Over the first 24–36 h, this response results in a net loss of collagen, but is followed by a net synthesis 36–72 h after exercise. Repeated training with rest periods that are too short can result in a net degradation of the matrix and lead to overuse injury.^{20,26,27,28}

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Tendon recovery

- Achilles tendon loaded 6-12 times body weight with running
- If recovery between trainings session are inadequate it might lead to further injury instead of recovery
- Tendinopathy a result of collagen degradation occurring to a greater degree than collagen synthesis
- In humans net increase in collagen synthesis first after 37-78 hours after a bout of exercise

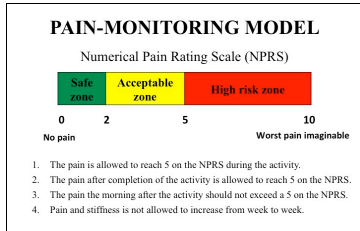
Clinical implication

Plan for 3 recovery days between heavy Achilles tendon-loading activities

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Pain and Symptoms

- Allow for pain during the rehabilitation
- During the Return to play stage the pain might be absent during activity so important to assess the following day



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31

Progression of tendon load

- Return to play is gradual progression in load
- Load on a tendon can be increased by ↑ load or speed of movement
- Walking loads the Achilles tendon 3.5 x body weight
- Achilles tendon loaded 6-12 x body weight with running
- Increased speed of running increases the load

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32

Progression of the load

- Strike pattern (Almonroeder et al. 2013)
 - Rearfoot strike pattern loads the Achilles tendon less than forefoot or midfoot
 - Using forefoot or midfoot strike pattern added an additional load of 48 x body weight for each 1.6 km
- High breaking force during running a risk factor (Lorimer et al. 2014)
 - Using shorter step length could be beneficial
- Stiffer running surfaces was related to decreased injury risk

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33

How to individualize the load?

The athlete's rating of perceived exertion of the Achilles tendon

TABLE 4 THE BORG CATEGORY-RATIO RATING OF PERCEIVED EXERTION SCALE¹¹

Score	Description
0	Nothing at all
0.5	Very, very weak
1	Very weak
2	Weak
3	Moderate
4	Somewhat strong
5	Strong
6	—
7	Very strong
8	—
9	—
10	Very, very strong

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34

The Classification Schema

Classification of activities	Pain level during activity NPRS (0-10)	Pain level after activity (next day) NPRS (0-10)	The Athlete's RPE (with regards to the Achilles tendon) (0-10)	Recovery days needed between activities	Examples of activities for a runner
Light	1-2	1-2	0-1	0 days (can be performed daily)	Walking for 70 min
Medium	2-3	3-4	2-4	2 days	Jogging on flat surface for 30 min
High	4-5	5-6	5-10	3 days	Running 85% of pre-injury speed for 20 min.

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35

Day	Activity	Symptoms/Perceived Exertion documented by the athlete
1	Jogging 30 min + Rehabilitation exercises	
2	Walking 70 min + Rehabilitation exercises	
3	Walking 70 min + Rehabilitation exercises	
4	Running 85% for 20 min + Rehabilitation exercises	
5	Walking 70 min + Rehabilitation exercises	
6	Walking 70 min + Rehabilitation exercises	
7	Walking 70 min + Rehabilitation exercises	
8	Running 85% for 20 min + Rehabilitation exercises	
9	Walking 70 min + Rehabilitation exercises	
10	Walking 70 min + Rehabilitation exercises	
11	Walking 70 min + Rehabilitation exercises	
12	Jogging 30 min + Rehabilitation exercises	
13	Walking 70 min + Rehabilitation exercises	
14	Walking 70 min + Rehabilitation exercises	
15	Running 85% for 20 min + Rehabilitation exercises	
16	Walking 70 min + Rehabilitation exercises	
17	Walking 70 min + Rehabilitation exercises	
18	Walking 70 min + Rehabilitation exercises	
19	Running 85% for 20 min + Rehabilitation exercises	
20	Walking 70 min + Rehabilitation exercises	
21	Walking 70 min + Rehabilitation exercises	

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36

62 year old runner
 Email 2 years after initiation of program
 At start of program unable to run

“Been a very good summer. The best pain free, injury free summer in ten years. I did nine races this summer, eight sprint triathlons and one olympic. Generally faster races than last year. Yesterday ran over ten miles with zero issues. One of the sprints I missed a transition area and ran barefoot for 5k in just over eight minute miles. Most of my races I am in the 8.45s range but did one in 8.12s and the 8.05s I mentioned. This is significantly faster.”

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Principles of Tendon Return-to-Sport program

- Progressively increase the demand on the tendon by controlling intensity, duration and frequency of Achilles tendon loading
- Continue with the rehabilitation exercises (tendon loading) during the return to sport phase (and continue for at least a year)
- Education
 - Easiest to educate about this phase when the athlete has a lot of symptoms
- Training diaries
- Initiate program early when athlete can perform activities of daily living with pain no higher than 2/10

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Take home message

- Full recovery of tendon “function” important for performance and does not directly relate to symptoms
- Treat minor symptoms of tendinopathy early with “load control” instead of ignoring
- Consider changes in sports performance as a possible sign of tendon overuse
- Use the Return to Play program as a model to individualize for each patient

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Thank you!



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