

TENDINOPATHY RESEARCH UPDATE - DECEMBER 2012

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NORMAL TENDON & PATHOLOGY

Matrix Biol. 2012 Nov 22. [Epub ahead of print]

Decorin Expression Is Important for Age-Related Changes in Tendon Structure and Mechanical Properties.

Dunkman AA, Buckley MR, Mienaltowski MJ, Adams S, Thomas SJ, Satchell L, Kumar A, Pathmanathan L, Beason DP, Iozzo RV, Birk DE, Soslowsky LJ.

Abstract

The aging population is at an increased risk of tendon injury and tendinopathy. Elucidating the molecular basis of tendon aging is crucial to understanding the age-related changes in structure and function in this vulnerable tissue. In this study, the structural and functional features of tendon aging are investigated. In addition, the roles of decorin and biglycan in the aging process were analyzed using transgenic mice at both mature and aged time points. Our hypothesis is that the increase in tendon injuries in the aging population is the result of altered structural properties that reduce the biomechanical function of the tendon and consequently increase susceptibility to injury. Decorin and biglycan are important regulators of tendon structure and therefore, we further hypothesized that decreased function in aged tendons is partly the result of altered decorin and biglycan expression. Biomechanical analyses of mature (day 150) and aged (day 570) patellar tendons revealed deteriorating viscoelastic properties with age. Histology and polarized light microscopy demonstrated decreased cellularity, alterations in tenocyte shape, and reduced collagen fiber alignment in the aged tendons. Ultrastructural analysis of fibril diameter distributions indicated an altered distribution in aged tendons with an increase of large diameter fibrils. Aged wild type

tendons maintained expression of decorin which was associated with the structural and functional changes seen in aged tendons. Aged patellar tendons exhibited altered and generally inferior properties across multiple assays. However, decorin-null tendons exhibited significantly decreased effects of aging compared to the other genotypes. The amelioration of the functional deficits seen in the absence of decorin in aged tendons was associated with altered tendon fibril structure. Fibril diameter distributions in the decorin-null aged tendons were comparable to those observed in the mature wild type tendon with the absence of the subpopulation containing large diameter fibrils. Overall, this work demonstrates structural and functional alterations in tendon associated with aging and that the absence of decorin prevents these age related changes.

Cell Tissue Res. 2012 Dec 5. [Epub ahead of print]

Human tenocytes are stimulated to proliferate by acetylcholine through an EGFR signalling pathway.

Fong G, Backman LJ, Andersson G, Scott A, Danielson P.

Abstract

Studies of human patellar and Achilles tendons have shown that primary tendon fibroblasts (tenocytes) not only have the capacity to produce acetylcholine (ACh) but also express muscarinic ACh receptors (mAChRs) through which ACh can exert its effects. In patients with tendinopathy (chronic tendon pain) with tendinosis, the tendon tissue is characterised by hypercellularity and angiogenesis, both of which might be influenced by ACh. In this study, we have tested the hypothesis that ACh increases the proliferation rate of tenocytes through mAChR stimulation and have examined whether this mechanism operates via the extracellular activation of the epidermal growth factor receptor (EGFR), as shown in other fibroblastic cells. By use of primary human tendon cell cultures, we identified cells expressing vimentin, tenomodulin and scleraxis and found that these cells also contained enzymes related to ACh synthesis and release (choline acetyltransferase and vesicular acetylcholine transporter). The cells furthermore expressed mAChRs of several subtypes. Exogenously administered ACh stimulated proliferation and increased the viability of tenocytes in vitro. When the cells were exposed to atropine (an mAChR antagonist) or the EGFR inhibitor AG1478, the proliferative effect of ACh decreased. Western blot revealed increased phosphorylation, after ACh stimulation, for both EGFR and the extracellular-signal-regulated kinases 1 and 2. Given that tenocytes have been shown to produce ACh and express mAChRs, this study provides evidence of a possible autocrine loop that might contribute to the hypercellularity seen in tendinosis tendon tissue.

Scand J Med Sci Sports. 2012 Dec 11. doi: 10.1111/sms.12023. [Epub ahead of print]

Differences in tendon properties in elite badminton players with or without patellar tendinopathy.

Couppé C, Kongsgaard M, Aagaard P, Vinther A, Boesen M, Kjaer M, Magnusson SP.

Abstract

The aim of this study was to examine the structural and mechanical properties of the patellar tendon in elite male badminton players with and without patellar tendinopathy. Seven players with unilateral patellar tendinopathy (PT group) on the lead extremity (used for forward lunge) and nine players with no current or previous patellar tendinopathy (CT group) were included. Magnetic resonance imaging was used to assess distal patellar tendon dimensions. Patellar tendon mechanical properties were assessed using simultaneous tendon force and deformation measurements. Distal tendon cross-sectional area (CSA) normalized for body weight ($\text{mm}^2/\text{kg}^{2/3}$) was lower in the PT group compared with the CT group on both the non-lead extremity (6.1 ± 0.3 vs 7.4 ± 0.2 , $P < 0.05$) and the lead extremity (6.5 ± 0.6 vs 8.4 ± 0.3 , $P < 0.05$). Distal tendon stress was higher in the PT group compared with the CT group for both the non-lead extremity (31 ± 1 vs 27 ± 1 MPa, $P < 0.05$) and the lead extremity (32 ± 3 vs 21 ± 3 MPa, $P < 0.01$). Conclusively, the PT group had smaller distal patellar tendon CSA on both the injured (lead extremity) and the uninjured side (non-lead extremity) compared with the CT group. Subsequently, the smaller CSA yielded a greater distal patellar tendon

stress in the PT group. Therefore, a small tendon CSA may predispose to the development of tendinopathy.

REHABILITATION

Open Orthop J 2012, 6 (Suppl 3: M10) 553-557

Eccentric Exercise Protocols for Patella Tendinopathy: Should we Really be Withdrawing Athletes from Sport? A Systematic Review

Saithna A, Gogna R, Baraza N, Modi C, Spencer S

Abstract

The 2007 review by Visnes and Bahr concluded that athletes with patella tendinopathy should be withdrawn from sport whilst engaging in eccentric exercise (EE) rehabilitation programs. However, deprivation of sport is associated with a number of negative psychological and physiological effects. Withdrawal from sport is therefore a decision that warrants due consideration of the risk/benefit ratio. The aim of this study was to determine whether sufficient evidence exists to warrant withdrawal of athletes from sport during an eccentric exercise rehabilitation program. A systematic review of the literature was performed to identify relevant randomised trials. Data was extracted to determine whether athletes were withdrawn from sport, what evidence was presented to support the chosen strategy and whether this affected the clinical outcome. Seven studies were included. None of these reported high quality evidence to support withdrawal. In addition, three studies were identified in which athletes were not withdrawn from sport and still benefited from EE. This review has demonstrated that there is no high quality evidence to support a strategy of withdrawal from sport in the management of patella tendinopathy.

MANAGEMENT

J Sport Rehabil. 2012 Nov;21(4):334-42.

Presentation and conservative management of acute calcific tendinopathy: a case study and literature review.

Scibek JS, Carcia CR.

Abstract

BACKGROUND:

The efficacy of a variety of noninvasive, conservative management techniques for calcific tendinopathy has been investigated and established for improving pain and function and/or facilitating a decrease in the size or presence of calcium deposits. Surprisingly, few have reported on the use of traditional therapeutic exercise and rehabilitation alone in the management of this condition, given the often spontaneous resorptive nature of calcium deposits. The purpose of this case is to present the results of a conservative approach, including therapeutic exercise, for the management of calcific tendinopathy of the supraspinatus, with an emphasis on patient outcomes.

CASE DESCRIPTION:

The patient was a self-referred 41-y-old man with complaints of acute right-shoulder pain and difficulty sleeping. Imaging studies revealed liquefied calcium deposits in the right supraspinatus. The patient reported constant pain at rest (9/10) and tenderness in the area of the greater tuberosity. He exhibited a decrease in all shoulder motions and had reduced strength. The simple shoulder test (SST) revealed limited function (0/12). Conservative management included superficial modalities and medication for pain and a regimen of scapulothoracic and glenohumeral range-of-motion (ROM) and strengthening exercises.

OUTCOMES:

At discharge, pain levels decreased to 0/10 and SST scores increased to 12/12. ROM was full in all planes, and resisted motion was strong and pain free. The patient was able to engage in endurance activities and continue practicing as a health care provider.

DISCUSSION:

The outcomes with respect to pain, function, and patient satisfaction provide evidence to support the use of conservative therapeutic interventions when managing patients with acute cases of calcific tendinopathy. Successful management of calcific tendinopathy requires attention to outcomes and an understanding of the pathophysiology, prognostic factors, and physical interventions based on the current stage of the calcium deposits and the patient's status in the healing continuum.

PHYSICAL THERAPIES

J Sport Rehabil. 2012 Nov;21(4):343-53.

Deep friction massage to treat tendinopathy: a systematic review of a classic treatment in the face of a new paradigm of understanding.

Joseph MF, Taft K, Moskwa M, Denegar CR.

Abstract

STUDY DESIGN:

Systematic literature review.

OBJECTIVE:

To assess the efficacy of deep friction massage (DFM) in the treatment of tendinopathy.

CONTEXT:

Anecdotal evidence supports the efficacy of DFM for the treatment of tendinopathy. An advanced understanding of the etiopathogenesis of tendinopathy and the resultant paradigm shift away from an active inflammatory model has taken place since the popularization of the DFM technique by Cyriax for the treatment of "tendinitis." However, increasing mechanical load to the tendinopathic tissue, as well as reducing molecular cross-linking during the healing process via transverse massage, offers a plausible explanation for observed responses in light of the contemporary understanding of tendinopathy.

EVIDENCE ACQUISITION:

The authors surveyed research articles in all languages by searching PubMed, Scopus, Pedro, CINAHL, PsycINFO, and the Cochrane Library using the terms deep friction massage, deep tissue massage, deep transverse massage, Cyriax, soft tissue mobilization, soft tissue mobilisation, cross friction massage, and transverse friction massage. They included 4 randomized comparison trials, 3 at the extensor carpi radialis brevis (ECRB) and 1 supraspinatus outlet tendinopathy; 2 nonrandomized comparison trials, both receiving DFM at the ECRB; and 3 prospective noncomparison trials-supraspinatus, ECRB, and Achilles tendons. Articles meeting inclusion criteria were assessed based on PEDro and Centre for Evidence-Based Medicine rating scales.

RESULTS:

Nine studies met the inclusion criteria.

EVIDENCE SYNTHESIS:

The heterogeneity of dependent measures did not allow for meta-analysis.

CONCLUSION:

The varied locations, study designs, etiopathogenesis, and outcome tools used to examine the efficacy of DFM make a unified conclusion tenuous. There is some evidence of benefit at the elbow in combination with a Mills manipulation, as well as for supraspinatus tendinopathy in the presence of outlet impingement and along with joint mobilization. The examination of DFM as a single modality of treatment in comparison with other methods and control has not been undertaken, so its isolated efficacy has not been established. Excellent anecdotal evidence remains along with a rationale for its use that fits the current understanding of tendinopathy.