Rupture of the tendo Achillis is a common injury and the incidence is rising. There is a bimodal distribution according to age with the first peak predominantly involving men aged 30 to 40 years and the second women aged 60 to 80 years. The first peak in incidence is often associated with participation in sport, such as football and racquet sports, whereas the second peak occurs during normal daily activities such as climbing stairs. However, both often occur below the threshold of ‘macro-failure’ that might be expected in a healthy tendon. Macro-failure is a term associated with the stress–strain curve that characterizes the mechanical response of tendons, and occurs beyond approximately 8% strain.

It is widely accepted that spontaneous ruptures are the consequence of a pre-existing tendinopathy, which itself is attributed to failure in the protective/regenerative function that responds to repeated microscopic injury. Tendinopathy may develop in individuals with no obvious predisposition, but it has been linked to a number of external factors including use of topical corticosteroids, fluoroquinolone antibiotics and mechanical abnormalities of the foot. Intrinsic factors have also been associated with a predisposition including autoimmune and neurological conditions.

The most common mechanism of injury is rapid eccentric contraction of the triceps surae, which may occur during sports with activities such as sprint starts, jumping and lunging or after an unexpected dorsiflexion of the ankle, which might occur when a patient stumbles. The patient typically presents with a sudden pain in the area of the tendo Achillis, often reporting a feeling of having been kicked in the back of the leg. Physical findings include a positive calf squeeze test, decreased ankle plantarflexion strength, presence of a palpable gap and increased ankle dorsiflexion with gentle manipulation. Following a diagnosis of a mid-substance rupture of the tendo Achillis the clinician is faced with a range of management options. This article will summarise the latest developments in this area.

Management options
Traditionally the key question in relation to a rupture of the tendo Achillis was simply whether to operate or not. In 1981 Nistor designed and published the first randomised control trial (RCT) to address this clinical question, involving 105 patients, all of whom underwent between six and nine weeks of immobilisation in a cast, irrespective of whether they were in the operative group. This study was followed by a series of trials which were pooled in a meta-analysis by the Cochrane review group in 2004. The results suggested a re-rupture rate of 3.5% in the operatively treated group and 12.6% in the non-operatively treated group. Therefore, operative repair seemed to reduce the risk of re-rupture but came with an increased risk of other complications, most of which were associated with infection and wound healing.
In an attempt to reduce the number of wound complications associated with operative repair, clinicians have investigated percutaneous repair, as opposed to the traditional open longitudinal approach. The percutaneous approach involves small stab incisions along both borders of the tendon and then passing a suture through the tendon using these incisions, as first described by Ma and Griffith. The first RCT to examine the benefit of this approach was published by Schroeder, Lehmann and Steinbrueck in 1997, followed by two further RCTs in 2001 and 2008. These have all reported favourably towards the percutaneous approach, regarding complication rates. However, it was also noted that there is a higher rate of sural nerve injury with percutaneous approaches. Consequently, a range of surgical techniques, which sit between the open longitudinal and fully percutaneous techniques, have been developed but there is currently no standard procedure amongst surgeons.

The 2004 Cochrane review also evaluated two RCTs published in 1992 and 2002, which compared cast immobilisation with functional bracing within patients managed non-operatively. These suggested that there was a reduced re-rupture rate of 2.4% in the functional bracing group, compared with 12.2% in the casting group. This raised the possibility that functional rehabilitation might reduce the rate of re-rupture to that observed in operatively managed patients, in which case the strength of the indication for surgical intervention was reduced. However, the authors of the review also noted the considerable variation in functional bracing protocols documented within the literature.

Functional rehabilitation

The term functional rehabilitation has been applied in various studies using a variety of orthotics and rehabilitation regimes. However, the key components are weight-bearing mobilisation, usually within an orthotic device with early, but limited, range of movement being permitted. With regard to the orthosis, there are two basic designs: rigid rocker bottom style or the more flexible carbon-fibre dorsal orthoses. The flexible orthosis generally facilitates a greater range of movement than the more rigid designs. The choice of orthosis is just one consideration. There is also the issue of what degree of plantarflexion should be maintained within the orthosis. Some studies have advocated that the ankle should be positioned in neutral (plantar-grade) but with restricted dorsiflexion, while others have used three heel-wedge inserts such that the ankle joint is initially maintained at near full plantarflexion. The latter protocol reproduces the more traditional use of sequential plaster casts with gradually reducing plantarflexion. Finally, there is the consideration of when weight-bearing should be permitted (day one or within first two weeks), for how long the orthosis should be worn and whether or not to permit active range of movement exercises throughout the period when the orthosis is worn. There is a trend towards immediate full weight-bearing and earlier removal of the orthosis with an average of eight weeks reported in one study, but it would be wrong to suggest that there is a consensus in this area.

This range of protocols exemplifies the complexity of this early rehabilitative intervention. When developing an intervention that has several interacting components the clinician can reasonably refer to the growing number of case series, documenting what has been tried and tested, and implement a protocol into their practice accordingly. An alternative approach, recommended by the Medical Research Council, is to develop an understanding of the underlying causal mechanisms why these different components may contribute to improved outcomes following a rupture of the tendo Achillis.

The phases of tendon healing have been divided into inflammation (first week), proliferation (weeks two to eight) and remodelling (up to 12 months). Throughout these phases the tendon’s tensile strength gradually increases, but remains inferior to the uninjured tissue. The biomechanical inferiority of the newly formed scar tissue is due to its increased stiffness and subsequently decreased visco-elastic properties. Animal models have shown that early loaded movement improves the biomechanical properties of the scar tissue, decreases excessive adhesion formation and subsequently enhances the gliding function of the tendon. Furthermore weight-bearing during the early phases of healing stimulates fibroblast activity and type III collagen synthesis. Consequently, there is both preliminary clinical evidence and underlying basic science research to support early loading and early movement.

The RCT using functional rehabilitation involved early, but not immediate weight-bearing. Subsequently, there were RCTs to compare cast immobilisation with ‘immediate’ full weight-bearing functional bracing, firstly within operatively managed patients and secondly within non-operatively managed patients. These studies suggested that immediate weight-bearing is safe, in terms of both risk of re-rupture and the risk of tendon lengthening, for both groups, and offer practical advantages for patients and some evidence of improved functional outcomes.

Operative versus non-operative treatment with functional rehabilitation

The next logical research question was therefore to compare operative with non-operatively managed patients using accelerated, functional rehabilitation methods for both groups. The first RCT for this step was carried out by Metz et al in 2008 and then more recently by Willits et al in 2010. Both studies used early functional bracing (within two weeks of injury) and both found no statistically significant differences in outcome between operatively and non-operatively managed patients. The primary outcome measures were complications other than re-rupture in one study and the rate of re-rupture in the other. Both RCTs had clear inclusion and exclusion criteria and accountability for participant flow throughout the studies. They provide strong
evidence to suggest that there is no difference in the risk of re-rupture whether the rupture is treated with operative repair or managed non-operatively, provided functional rehabilitation is undertaken in the early phases of rehabilitation. However there are some unresolved issues. For example, Metz et al. managed the two groups using somewhat different rehabilitation protocols. In contrast, Willis et al. used an identical rehabilitation protocol for both groups, but the patient sample was recruited from two sports medical centres, bringing into question the external validity of the results. Furthermore it is important to acknowledge that both studies used complications as their primary measure of treatment success. The most appropriate measure of the success of treatment, however, remains controversial.

Outcome measures
In order to ascertain superiority of one intervention over another, the appropriate choice of primary outcome measure is imperative. Traditionally, within the musculoskeletal field, published studies have focused on the technical outcomes of procedures, but more recently there has been a move towards the assessment of effectiveness from the patients’ perspective. A wide range of patient reported functional measures have been developed over the last two decades, such as the Victorian Institute of Sports Assessment questionnaire for patellar and Achilles tendinopathy, and in other areas assessments for both the upper and lower limb. However, until recently there was no validated, patient-reported outcome tool specifically for tendons, bringing into question the external validity of the results. Furthermore it is important to acknowledge that both studies used complications as their primary measure of treatment success. The most appropriate measure of the success of treatment, however, remains controversial.

In conclusion, although current evidence points to the use of early functional rehabilitation, regardless of operative or non-operative management, there is no consensus on which functional rehabilitation protocols should be used. Unanswered questions include: Which type of orthosis should be used? Is movement important or is early loading enough? What degree of plantarflexion provides the best balance between tendon lengthening/re-rupture and disuse atrophy in the calf muscles? The next few years of research will no doubt improve our understanding of these ‘mechanical’ factors but perhaps the most exciting developments will come with a better knowledge of how the mechanical and biological environment interacts in the tendon Achilles as it heals.

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References