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Ultrasound characteristics of the lateral retinaculum in 10 patients with patellofemoral pain syndrome compared to healthy controls

Esther J.M. Schoots, MD [a,*], Igor J.R. Tak, MSc [b], Bertil J. Veenstra, MSc [c], Yvonne M.J. Krebbers, MD [d], Jaap G. Bax, MD [e]

[a] *Utrecht Sports Medical Center (SMA Utrecht), Uppsalalaan 3, 3584 CT Utrecht, The Netherlands*
[b] *Physiotherapy Practice 'Utrecht Oost', The Netherlands*
[c] *Department of Training Medicine and Training Physiology, Royal Netherlands Army, The Netherlands*
[d] *Diakonessenhuis Utrecht, The Netherlands*
[e] *Utrecht Sports Medical Center, The Netherlands*

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Summary *Background:* Histopathologic changes of the lateral retinaculum are described in patients with patellofemoral pain syndrome (PFPS). No information is available on the presence of structural changes of the lateral retinaculum on ultrasound examination in patients with PFPS.
Purpose: To describe ultrasound characteristics and colour Doppler findings in patients with unilateral PFPS and in healthy controls.
Methods: 10 patients with unilateral PFPS and 10 healthy control subjects underwent ultrasound and colour Doppler examination of the lateral retinaculum of both knees. Thickness of the lateral retinaculum was measured at three predefined locations. In addition presence of neovascularisation was assessed.
Results: Thickness of the lateral retinaculum of both affected (mean [SD] of three locations 4.0 [1.4] mm, 95%CI: 1.2–6.8) and asymptomatic (3.7 [0.8] mm, 95%CI: 2.1–5.3) knees was increased in the patient group compared to the control subjects (3.0 [0.1] mm, 95%CI: 2.8–3.2), although not reaching statistical significance. Positive colour Doppler signals of the lateral retinaculum were found in 4 patients and in none of the control subjects (4/10 versus 0/10; 2 × 2 Fisher's exact test 1-tailed $p = 0.0433$; 2-tailed $p = 0.0866$; mid p value $= 0.0217$).

* Corresponding author. Tel.: +31 6 50534185; fax: +31 30 6992422.
E-mail address: eschoots@planet.nl (E.J.M. Schoots).

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Conclusions: The results of these measurements indicate a trend towards a larger thickness of the lateral retinaculum and showed neovascularisation measured by ultrasound and colour Doppler examination in patients with PFPS. The larger thickness of the lateral retinaculum on ultrasound examination was found in both affected and in asymptomatic knees of the patients, supporting the concept that PFPS is a bilateral rather than a unilateral disorder. Further research is needed to unravel the role of the lateral retinaculum in pathogenesis of PFPS and to clarify the role of the lateral retinaculum as a target for therapy in patients with PFPS.

Introduction

Patellofemoral pain syndrome (PFPS) is a common disorder and accounts for a quarter of knee injuries seen in sports medical practice (Baquie and Brukner, 1997; Devereaux and Lachmann, 1984). PFPS is characterized by peripatellar pain in absence of other pathologies. Patellofemoral pain is provoked by weight bearing activities like running, jumping, stair climbing, squatting and by prolonged sitting with flexed knees. Through the years, several theories on the pathogenesis of PFPS have been postulated. Chondromalacia was held responsible for PFPS until the seventies of the last century, but different studies revealed no clear relationship between anterior knee pain and chondromalacia (Aleman, 1928; Royle et al., 1991; Sanchis-Alfonso, 2011). From that time until the end of the twentieth century, PFPS was mainly explained as the result of patellofemoral malalignment (Ficat et al., 1975; Holmes and Clancy, 1998; Hughston, 1968; Insall, 1979). Currently the concept of patellofemoral malalignment is questioned because not all patients with patellofemoral malalignment are symptomatic. On the other hand, many patients with anterior knee pain lack signs of patellofemoral malalignment of the patellofemoral joint on computed tomography (Sanchis-Alfonso, 2008). In 1996 Dye shed new light on the pathogenesis of knee complaints by postulating the model of tissue homeostasis and in 1999 this model was adapted to PFPS (Dye, 1996; Dye et al., 1999). Dye stated that in the pathogenesis of patellofemoral pain, loss of homeostasis of innervated patellofemoral tissues plays a more important than the presence of structural abnormalities. In the model of tissue homeostasis, patients with a normal anatomy of the patellofemoral joint can become symptomatic when they are exposed to a supraphysiologic load, whereas patellofemoral malalignment might act as a predisposing factor in the development of PFPS (Post, 2005; Sanchis-Alfonso et al., 1998). Patellofemoral malalignment impairs tissue homeostasis and leads to provocation of peripatellar pain after minimal or moderate changes in loading of the knee. According to Dye the most likely sources of nociceptive output in patients with patellofemoral pain are the innervated peripatellar soft tissues and the intraosseous environment of the patella. In this context authors have emphasized the role of the lateral retinaculum in the provocation of pain in PFPS (Fulkerson, 1983; Fulkerson et al., 1985; Mori et al., 1991; Sanchis-Alfonso et al., 1998, Sanchis-Alfonso and Roselló-Sastre, 2000, Sanchis-Alfonso et al., 2001, 2005). Fulkerson described demyelinisation and fibrosis in the lateral retinaculum of patients with patellofemoral pain, which resembles the histopathologic picture of Morton's neuroma (Fulkerson et al., 1985). Mori et al. showed degenerative changes of the nerves in the lateral retinaculum of patients with patellofemoral pain (Mori et al., 1991). Sanchis-Alfonso et al. found hyperinnervation and hypervascularisation of the lateral retinaculum in patients with PFPS (Sanchis-Alfonso et al., 1998, 2005; Sanchis-Alfonso and Roselló-Sastre, 2000). According to the histopathology of tendinosis, Sanchis-Alfonso et al. did not find signs of inflammation in the lateral retinaculum in these patients (Sanchis-Alfonso et al., 1998, 2005; Alfredson et al., 1999, 2001, Alfredson and Lorentzon, 2003).

In longstanding tendinopathy histopathologic changes in collagen lead to abnormal signals on sonographic evaluation of the tendon (Peers and Lysens, 2005; Mitchell et al., 2009). Ultrasound examination of tendinosis shows swelling of the tendon often combined with disturbances in the organisation of collagen with hypoechogenic zones. On power Doppler ultrasonography neovascularisation can be demonstrated in tendinosis. In the literature there is scarce information about the ultrasound aspect and anatomy of the lateral retinaculum, mainly obtained from cadaveric knee specimens (Starok et al., 1997). As far as we know there are no studies that describe the ultrasound characteristics of the lateral retinaculum in patients with PFPS or in healthy subjects. The aim of the current study was to gather information on the ultrasound characteristics of the lateral retinaculum in 10 patients with unilateral PFPS and to compare those characteristics with 10 healthy volunteers. We hypothesized that thickness of the lateral retinaculum in the affected knee of patients with PFPS would be larger compared to the unaffected knee and compared to the control subjects.

Methods and subjects

Subjects

For this observational study 10 patients with unilateral PFPS who satisfied the inclusion criteria (Table 1) were recruited from our sports medical practice and outpatient physiotherapy department. Prior to the study all patients underwent a physical examination of both knees to rule out passive instability and joint line tenderness. In the patients X-ray examination of the affected knee was performed to rule out patella alta and signs of patella dysplasia. Ten control subjects without any history or presence of knee complaints were recruited from hospital staff. Before admittance all participants were given both oral and written information regarding the nature and purpose of the study. All participants gave their informed consent for participation in the study.