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Treatment of recalcitrant patellar tendinosis: can the peignage technique be a viable alternative?

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Summary

Objective. Patellar tendinopathy typically affects young athletes engaged in running and jumping activities. If conservative therapy fails at one year, surgery generally leads to therapeutic success. This study evaluated the clinical effectiveness of the "peignage" technique combined with PRP infiltration.

Methods. Since 2018 we have treated 7 active patients with open patellar "peignage" technique, excision of degenerations, micro-perforation,s and PRP infiltration, subsequently subjected to a standardized 3-month rehabilitation protocol.

Results. There was a reduction in the mean VAS pain from 7.2 to 2.5 points and functional improvement on the VISA-P-I scale from 49 to 85% between pre- and post-operative periods (1 year follow-up), with statistically significant differences.

Conclusions. In resistant cases of patellar tendinopathy, the combined use of surgery and orthobiologics allows the athlete to return to pre-injury activities, with good results regarding pain and function. The lack of high-quality evidence studies does not allow systematic conclusions on patellar "peignage" to be drawn; however, the case series present in the literature underline good clinical efficacy.

Level of evidence. IV, Case series, prospective.

Key words: patellar tendinopathy, open tenotomy, debridement, microfractures, platelet-rich-plasma

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Introduction

Patellar tendinopathy (PT) is a leading cause of anterior knee pain in young athletes and affects more than 14% of the sports population [1]. It affects relatively young people (15-30 years), mainly men, who participate in activities such as basketball, volleyball, athletics, tennis, and football that require repetitive tendon loading (jumper's knee) [2].

The pathogenesis of PT is related to the stress overload on the deep posterior region of the tendon.

Microscopic examination of abnormal tendon tissues shows a non-inflammatory process with disordered arrangement of collagen fibers, increased vascularization, and poor tendency to heal [3]. An angioblastic reaction is present, with a random orientation of blood vessels, sometimes at right angles to collagen fibers, mediated by vascular endothelial growth factor (VEGF). Inflammatory lesions and the presence

of granulation tissue are uncommon and, if present, are associated with tendon ruptures. Collagen degeneration, mediates by metalloproteinases (MMP), is of either mucoid or lipoid variety and the characteristic hierarchical structure of collagen fibers is lost. In the paratenon, mucoid degeneration, fibrosis, and vascular proliferation, with a slight inflammatory infiltrate, have been reported [3].

The mechanical impingement and compression of the inferior patellar pole onto the posterior aspect of the patellar tendon in flexion is another important factor in the pathogenesis [4]. Determining increased tendon thickness of the posterior part of the proximal patellar tendon in the place of impingement with the elongated lower patellar pole, Andonovski concluded that this was a more compatible mechanism in pathogenesis than in tendon stress overload alone.

Patellar tendinopathy, as one of many potential diagnoses producing anterior knee pain, has specific and defining hallmark clinical features that consist of pain localized to the inferior pole of the patella and load-related pain that increases with the demand on the knee extensors, notably in activities that store and release energy in the patellar tendon [2]. Other signs and symptoms, such as pain with prolonged sitting, squatting, and stairs, may be present but are also features of patellofemoral pain (PFP) and other pathologies. Tendon pain occurs instantly with loading and usually ceases almost immediately when the load is removed. Pain is rarely experienced in a resting state. Pain may improve with repeated loading (the "warm-up" phenomenon), but there is often increased pain the day after energy-storage activities [2]. Clinically, it is noted that dose-dependent pain is a key feature, and assessment should demonstrate that the pain increases as the magnitude or rate of application of the load on the tendon increases.

The diagnosis is purely clinical, using an accurate history study, palpation, and administration of tests that demonstrate the athlete's attempt to compensate for the painful flexion with vertical landing (hip extension) after the jump. Both ultrasound and magnetic resonance imaging may show pathological intra-tendon signs in asymptomatic individuals and are not proportional to the severity of symptoms or to their improvement [3].

Following the canonical classification of Blazina [5], early symptomatic PT (Phases I and II) is often treated conservatively, such treatment including oral medications (non-steroidal anti-inflammatory drugs and corticosteroids), rest, immobilization, physical therapy (cryotherapy, extracorporeal shockwave therapy, ESWT) and eccentric exercise therapy [3]. New minimally invasive (MIT) topical techniques, such as platelet-rich-plasma (PRP) infiltrations or ultrasound-guided dry needling, are reserved for recalcitrant cases [6]. However, conservative treatment modalities aimed at modulating inflammation have had limited success in treating severe PT and also do not prevent painful conditions arising from overuse of tendons.

In case of failure of conservative therapy at a minimum of 6 months to 1 year, which affects about 10% of treated patients [3], a surgical approach, open or arthroscopic, is required, without a consensus on the ideal approach [7]. Open or arthroscopic surgery techniques make it possible to relieve the pain and restore function rapidly in patients who are unresponsive to nonoperative treatment. Such surgery aims to minimize tissue damage, mitigate compression at the attachment point and promote local blood circulation [8], with the aim of stimulating a new reparative cascade thanks to the contribution of orthobiologics [9].

The purpose of our report is to evaluate the clinical effectiveness of the "peignage" technique combined with PRP infiltration in cases of recalcitrant patellar tendinosis at a minimum of one year follow-up.

Materials and methods

We enrolled 7 patients (all males, 19 to 57 years old, mean age 33), including 5 sportsmen (3 football and 2 basketball players) and 2 moderately active – who had undergone surgical treatment between January 2018 and February 2019. Inclusion criteria were a grade I-III PT according to Blazina's scale (grade 2 pathology in 3 cases and grade 3 in 4 cases) and unsuccessful conservative therapy for more than 6 months. Patients with complete tendon disruption (Phase IV) and those who were unable to cooperate were excluded.

All patients underwent careful clinical exam and MRI of the affected knee, which demonstrated the classic finding of increased signal intensity of the proximal patellar tendon (Fig. 1). Open "peignage" technique for the PT was performed. In detail, a midline skin incision centered on the patellar tendon is performed. Sharp dissection is undertaken down to the paratenon. Dissection is then performed medially and laterally to expose the whole patellar tendon. Multiple longitudinal incisions ("peignage") along the tendon fibers are performed with a No. 15 blade in the area of partial detachment and tendinopathy. The necrotic area of the tendon is debrided, and a rongeur is used to decorticate the distal pole of the patella to arrive at fresh bone. Moreover, multiple microperforations of the distal pole are made with a 2.5 mm k-wire to enhance the healing potential of the tendon attachment after debridement [6].

A PRP coat is placed under the tendon to stimulate further healing and a larger growth factor response (Fig. 2). After PRP injection, the paratenon is closed. The deep tissue layer is then closed with No. 0 and No. 2-0 Vicryl. The tourniquet is deflated and hemostatic control is obtained. The skin layer is then closed with Monocryl and a sterile dressing is applied.

The standardized rehabilitation period was about 3 months [8]. The knee was immobilized with a knee brace in extension for 2 weeks in PT grade II patients and 3 weeks in PT grade III patients. The brace was taken only for passive range of motion exercises. Motion was gradually and partially restored until the third post-operative week, hence knee flexion more than 90° and full weight bearing on the operated leg was allowed 3 weeks after the surgery. Gradual return to unrestrict-

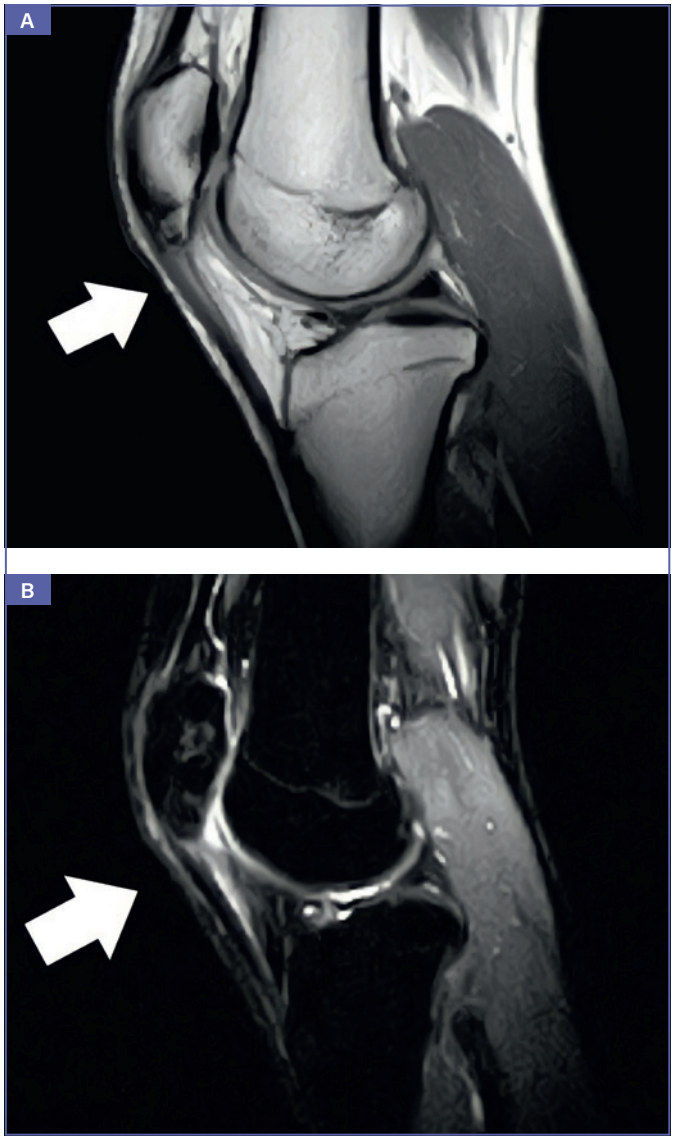

Figure 1 A-B. Sagittal MRI view in a chronic case showing enthesophyte and increased signal intensity both in T1 and T2 images of the proximal patellar tendon matrix (*arrow*).

ed competition was advised after the 8th post-operative week. The follow-up was made at a mean of 3 and 12 months after surgery (3.8 ± 0.7 and 13.2 ± 1.1 months, respectively). A detailed history was taken from all patients in order to assess the persistence of knee pain, level of sports activities, and number of months until athletes were able to perform specific exercises without any or only minimal pain. In all patients, a standardized clinical examination (palpation of the lower patella pole and the area between the lower pole of the patella and the patellar tendon, one legged stance test and light squats) was performed to determine if there were still persisting symptoms of

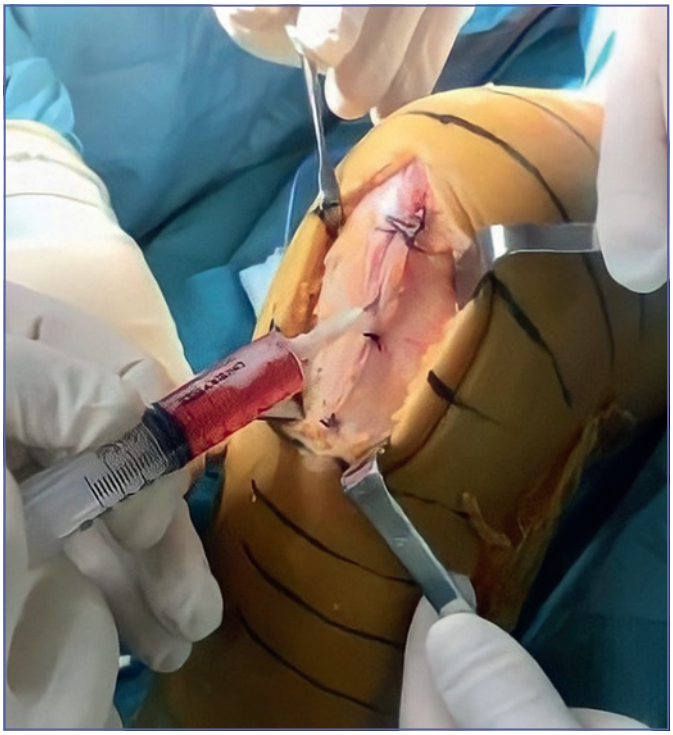

Figure 2. Platelet-rich-plasma (PRP) inserted during paratenon closure.

PT. All patients completed the questionnaire and scores from both the VAS and the VISA-P-I [11] knee scoring system were used for assessment of postoperative outcomes.

For statistical analysis, all data were expressed as mean and standard deviation. Comparison between pre-operative and two postoperative values was performed with one-way Anova test. Statistical significance was defined as a p-value < 0.05.

Results

All 7 patients continued with sport activities. In all patients the surgery had a favorable outcome without complications. Five of 7 patients strictly followed the rehabilitation protocol. The median time to return to preinjury level of activity was 3.5 ± 0.9 months. At 1 year follow-up, 6 of 7 patients (86%) were completely satisfied with the treatment, one (14%) somewhat, and none dissatisfied.

At the first follow-up (3 months), patients showed a major improvement in the mean VAS score from 7.2 ± 0.8 to 4.6 ± 1.3 and in the mean VISA-P-I score from 49 ± 3% to 70 ± 4.2%. At the final follow-up (one year), patients showed additional improvement in the mean VAS score of 2.5 ± 1.1 and in the mean VISA-P-I score of 85 ± 1.9%. Performing one-way Anova test, significant differences were found between pre-operative and 3

months and 1 year post-operative groups in VAS and VISA-P-I scores (p-value of 0.014 and 0.021 respectively).
There were no post-operative complications such as knee infections or stiffness and no deep vein thrombosis in any patient.

Discussion

In young athletes, where PT is a condition strongly limiting sport performance [2], treatment with "peignage" combined with PRP injection [8] allows to significantly reduce pain (VAS 7.2 *versus* 2.5) and improve functional outcomes (VISA-P-I from 49 to 85%). The same results were found in the middle-aged patients examined. About 1 year after the surgery, all patients returned to their previous sporting or working activities.
For severe and recalcitrant cases, open or arthroscopic procedures have been reported to be effective treatment options [14]. Regardless of the surgical technique undertaken, excision of all macroscopic degenerated tissue is emphasized. Moreover, decortication at the distal pole of the patella has been previously described to maximize healing potential [9]. Both surgeries give satisfactory results with success rate of more than 77% and arthroscopic surgery is associated with fewer complications, faster return to preinjury level of sport activities, and a non-significant higher success rate [4]. A review of 21 studies showed no significant differences regarding return to sports and surgical success rates between arthroscopic and open procedures [9].
Severe PT is often accompanied by extensive changes to the patellar tendon, comprising accumulation of calcified tissue and osteophyte formation. Complete debridement of the degenerated tissue and excision of osteophytes is required for surgical treatment to be successful. Although arthroscopic approaches and partial drilling can decompress surrounding tissue, these methods do not involve completely stripping calcified or degenerated tendon tissue, nor do they permit removal of proliferative osteophytes, limiting their clinical efficacy. Conventional resection is considered the most effective treatment for severe PT [8]. We chose a midline incision, which enables complete removal of degenerated and calcified tissue within the patellar tendon and at the attachment point, as well as osteophyte resection.
Another possible treatment, which can be performed in isolation or as an adjunct to open or arthroscopic surgical treatment, is PRP injection [15]. The application of PRP has been associated with tendon healing and remodeling as a result of growth factors that lead to matrix production and heightened tenocyte activity. Several studies have shown symptomatic improvement and evidence of improvement on imaging in patients with patellar insertional tendinopathy after application of PRP [4].
The last issue that is under question is the necessity of resection of the lower patellar pole during the arthroscopic surgery. It is assumed that a longer non-articular inferior patellar pole might be a risk factor for the onset of patellar tendinopathy because of the impingement between these two structures in knee flexion [4]. In our series, we performed scarifications and micro-perforations of the lower patellar pole, with very satisfactory results.

Conclusions

The patellar "peignage" technique with PRP infiltration is effective in the treatment of patellar tendinosis and allows the athlete to return to a level of activity similar to the pre-injury period, also due to the reparative contribution of the PRP injection and to a targeted rehabilitation program [7,12]. In the literature there is a lack of large-scale studies [13], limited instead to cohorts of a few dozen patients.
Our study has some limitations: we had a relatively small number of subjects, the duration of follow-up was too brief to assess long-term functional restoration and the incidence of recurrence. In terms of evidence-based medicine, case reports have inherent limitations. Randomized, controlled trials are thus needed to address these limitations and compare the results of different surgical techniques and the aid of orthobiologics [7-9].

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Conflict of interest statement
The Authors declare no conflict of interest.

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Authors' contributions
VR, VC conceived, drafted and finalized the paper; AM, AV, GBD, AG collected and analyze relevant bibliography and contributed to writing and finalizing the manuscript. All the Authors read and approved the final manuscript.

Ethical consideration
This study was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

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