Case Report
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Regeneration of the Patellar Tendon with Radial Pressure Waves in a Sharp Injury: A Case Report

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Abstract

Patellar tendon ruptures are rare injuries and are more commonly associated with predisposing factors and previous surgical procedures than with direct trauma. Acute partial-thickness tears are usually treated with immobilization and rehabilitation. The literature recommends surgical management of partial ruptures of the patellar tendon after 6 months of failure of conservative treatments and in acute cases with a compromise >50–55% of the tendon. Radial pressure wave therapy is a safe, non-invasive technique with scientific support in tissue regeneration; it is found as one of the therapeutic alternatives for the management of tendinopathy and partial ruptures of the patellar tendon. The present case report shows the effectiveness of radial pressure wave therapy in a shear injury of the patellar tendon, with a compromise of at least 70%. We have not found similar cases previously reported in the literature, highlighting its relevance.

Keywords: Patellar tendon, Radial pressure waves, Patellar tendon rupture, Cutting injury

Introduction

Acute ruptures of the patellar tendon are rare injuries that alter the distal portion of the knee extensor mechanism [1]; they are more common in men and have a prevalence of 0.6%. More than a direct trauma, it is associated with predisposing factors such as obesity, iatrogenesis, being high-performance or occasional athletes with chronic tendinopathy [2], systemic diseases (rheumatoid arthritis, systemic lupus erythematosus, diabetes, and hypothyroidism), prolonged use of corticosteroids, chronic kidney disease, use of fluoroquinolones [3, 4], advanced age, and previous surgical procedures such as total knee arthroplasty [5-8]. In the clinical examination, patients usually present localized pain, tense hemarthrosis of the knee, and inability to bear weight on the affected limb, among other data [9]. Magnetic resonance imaging (MRI) evaluation is the most sensitive modality and can help determine partial versus full thickness tears, the location of the tear, tendon degeneration, and associated soft tissue injuries [10]. Acute partial thickness tears are generally treated with non-surgical strategies, such as complete immobilization in extension with subsequent rehabilitative management [11].

Since its first uses and applications in orthopedics at the end of the eighties [12], extracorporeal shock waves (ESWT) efficiency have opened a range of therapeutic alternatives to conventional management in musculoskeletal injuries, being a non-invasive, safe technique with scientific support in tissue regeneration [12,13]. They generate a biological response in tissues by a mechanical stimulus (mechanotransduction) acting at the cellular, molecular and tissue level, generating neovascularization, anti-apoptosis, chondroprotective effect, anti-inflammatory, immunomodulatory, tissue and nerve regeneration, through growth factors, interleukins, nitric oxide, and other cell proliferation factors [13,14].

The term ESWT includes two types of technologies, focused shock waves and radial pressure waves (RPW). They differ in the type of generator, physical characteristics, mechanism of action, and risk, although they share some indications and contraindications [15]. It is also of interest to mention that some radial pressure wave generators have applicators that can slightly concentrate the pressure field [16].

RPW is not considered real ESWT because they have different physical characteristics, they do not reach a high-pressure level (100–150 MPa) just around 30 MPa, nor the necessary speed (10 ns), although they generate cavitation. They create a pressure wave through the compression of air accelerated by a projectile inside a cylindrical tube or by electromagnetic induction. This generated energy is deposited on the skin by

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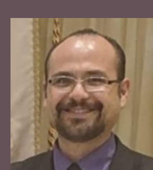
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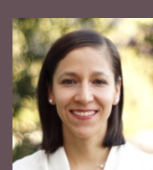
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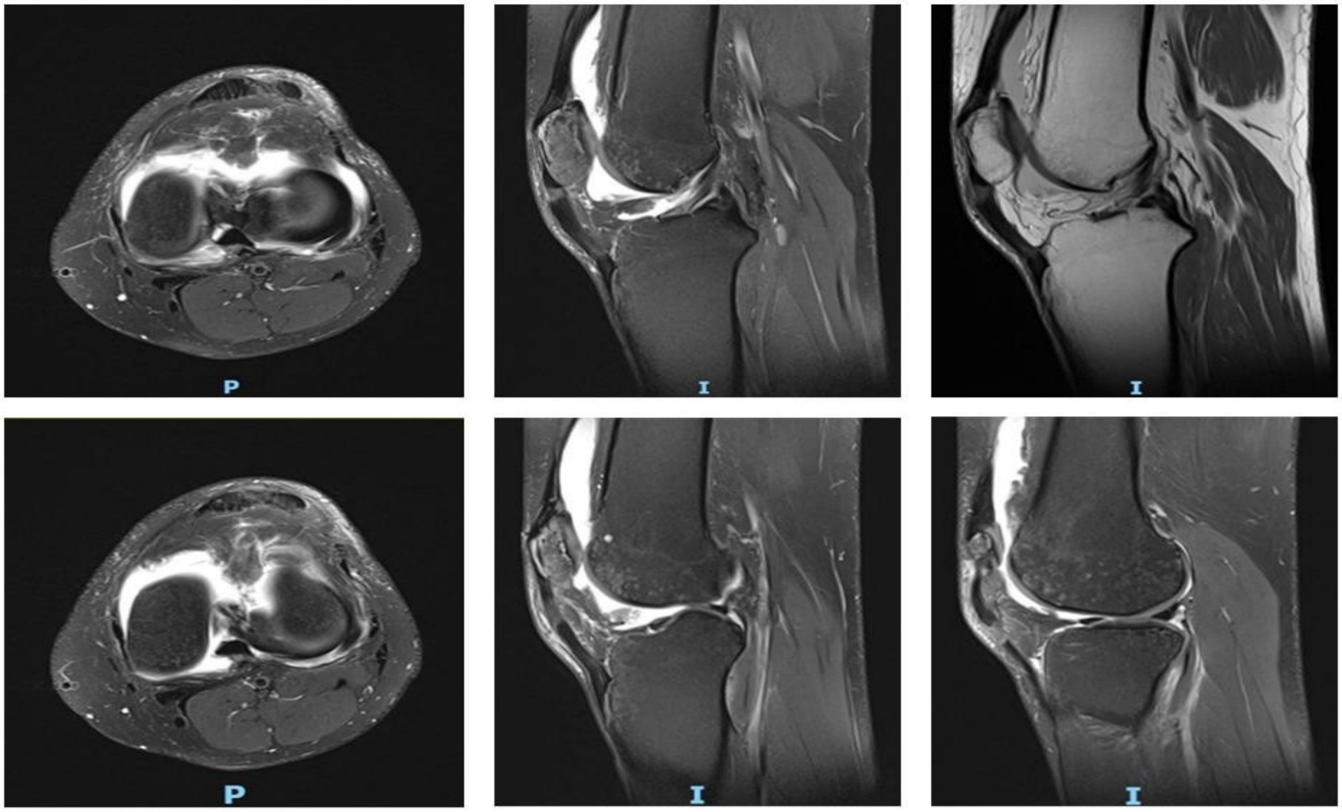

Figure 1: Magnetic resonance imaging in DP FATSAT axial planes; sagittal T2 FATSAT and sagittal DP where a tear of at least 70% in the patellar tendon is identified, as well as abundant joint fluid that communicates to the suprapatellar bursa.

an applicator and transmitted to the tissue through radial waves. The pressure level in the device is measured in Bar [14, 15].

Regarding the indications in different musculoskeletal pathologies, various studies have shown favorable results of the use of mechanical waves therapy in athletes with patellar tendinopathy and rupture of the patellar tendon, with a success rate ranging from 73.5% to 87.5% [17]; However, when talking about conservative management in rupture of the patellar tendon due to direct trauma, there is no literature at the time that guides action, especially in a cutting injury, which is why the following case report is made, being the first to demonstrate the effectiveness of the use of RPW in this type of injury.

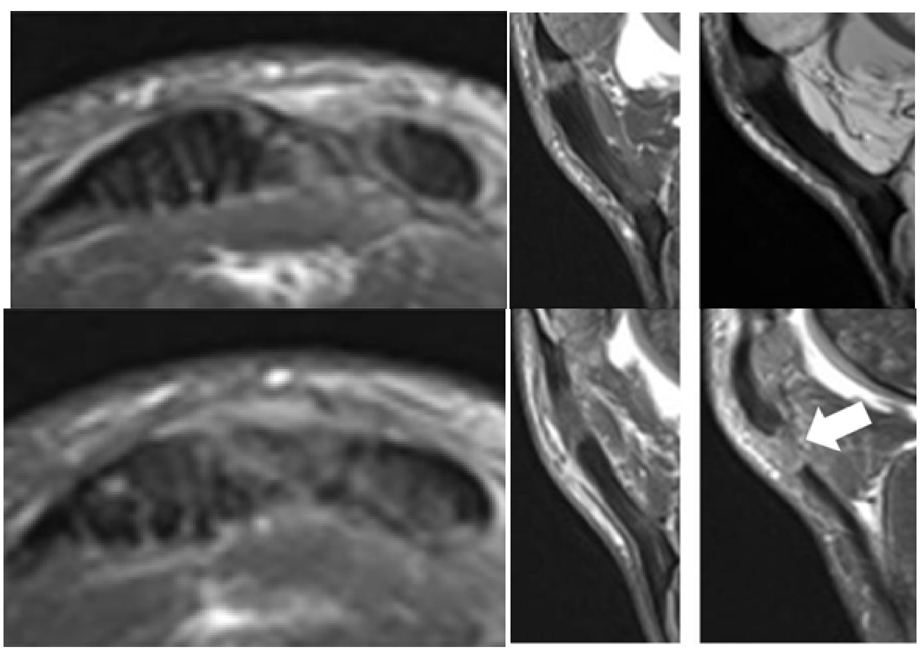

Figure 2: Magnified magnetic resonance imaging images in DP FATSAT axial planes; sagittal T2 FATSAT and sagittal DP where a tear of at least 70% in the patellar tendon is identified, as well as abundant joint fluid.

Case Report

We present a 35-year-old male patient employed by railroads in Chihuahua Mexico, with Grade I or moderate obesity [18] (body mass index 33.9), allergic to penicillin, and not an athlete. He lifted a glass object (fish tank) and broke it on the spot, presenting 3 cut wounds to his left knee. He was assessed in the emergency service of a private hospital where he received wound asepsis, pharmacological management with analgesics, unspecified antibiotics, and primary closure with sutures. He did not have medical follow-up after the suture

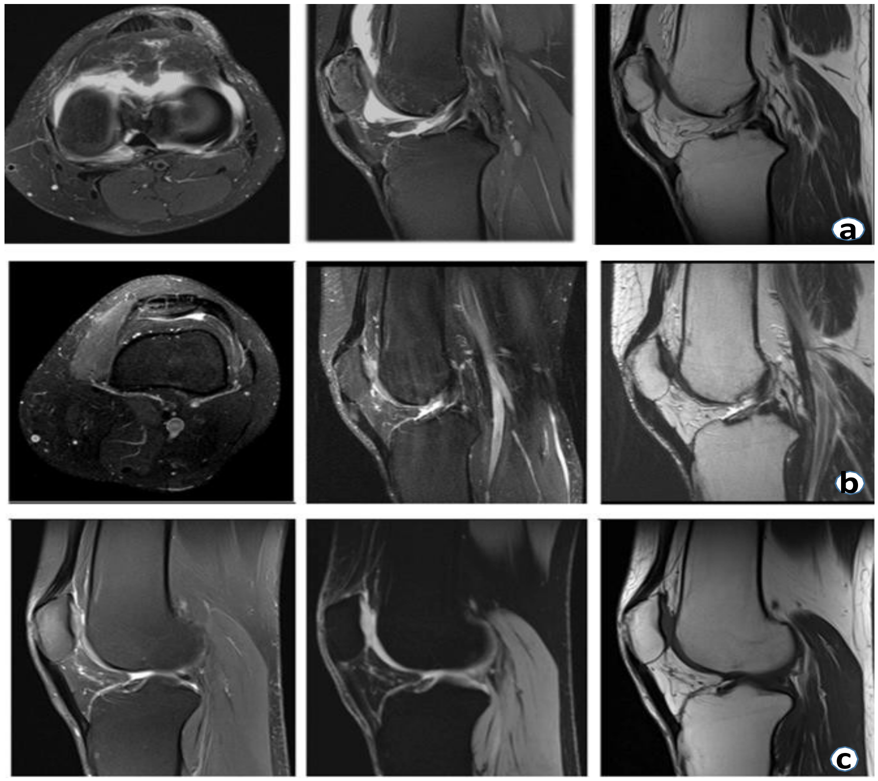

Figure 3: (a) Initial magnetic resonance imaging. (b) Magnetic resonance imaging 4 months after the last RPW session, DP FATSAT axial planes; sagittal T2 FATSAT and sagittal DP where a decrease is identified in the hyper intense area of patellar tendon damage with fiber regeneration. (c) magnetic resonance imaging 12 months after the last RPW session, sagittal planes weighted in DP FATSAT, T2 FATSAT and T1 where generalized integrity is identified in the patellar tendon, without data of previous or remaining injury.

removal was performed, evolving with pain and functional limitation of the knee.

After 9 weeks, he was evaluated by a doctor specialized in rehabilitation medicine, presenting a faltering gait at the expense of the left lower limb with poor knee flexion, increased volume and temperature of the left knee, generalized pain on palpation, very painful ranges of motion, preserved sensitivity and muscle strength not assessable because of pain. An MRI study of the left knee was requested, and an orthopedic surgeon was consulted for joint management.

Areas of rupture of the patellar tendon were found on MRI with approximately 70% tendon thickness involvement. The injury area was located predominantly close to the patellar insertion site in the lateral area, joint effusion with extension toward the suprapatellar bursa, and a posterior medial meniscal lesion with a degenerative appearance (Figs. 1 and 2).

Initial conservative management was chosen. The patient received a cycle of 10 physiotherapy sessions (superficial thermotherapy, analgesic electrotherapy, sonotherapy, and kinesiotherapy) 1 session daily, 5 days/week, with the objectives of controlling pain and edema of the left knee, improving mobility, muscle strength, and gait pattern. At the end, there was improvement in mobility of the left knee and a decrease in edema, but intense pain persisted throughout the entire patellar tendon. For this reason, RPW therapy was applied (Easy BTL 6000 equipment), a protocol with a frequency of 6–8 HZ, 3000 shots, pressure value 2.5 bar, sweeping the tendon from the lower pole of the patella to the anterior tuberosity of the tibia. A total of 4 RPW sessions were carried out at intervals of one session every 7–10 days, with remission in symptoms reported by the patient, as well as return to work.

During follow-up, there were no relapses of the symptoms. RMN studies were performed at 4 and 12 months after the last RPW session. Initial MRI images can be seen in Fig. 3a. At 4 months, a decrease was found in the hyperintense zone of damage of the patellar tendon with fiber regeneration (Fig. 3b) and at 12 months, generalized integrity in the patellar tendon was evident (Fig. 3c).

Discussion

The use of RPW in patellar tendon pathology has shown its effectiveness and safety. It has a Grade B recommendation in the case of tendinopathies with or without partial rupture of the tendon (Level II and III of evidence studies) [13,19]. On the other hand, no significant differences have been found between the use of RPW and focused shock waves in patelar tendinopathies [20].

Their specific mechanism of action on the tendon remains uncertain, although it has been described that they act through effects such as cavitation, increased permeability of the cell membrane, ionization of biological molecules, cellular stimulation release of biomolecules such as adenosine triphosphate, as well as modulation of angiogenesis, among others [21].

With respect to patellar tendon rupture, a classification has been proposed for partial tears, based on the anteroposterior thickness of the tendon and the percentage of tendon tear [9]. Surgical debridement and possible repair are recommended for tears >50%, after 6 months of failure of conservative treatments such as rehabilitation (eccentric, concentric, and coordination exercises), dry needling, ultrasound, and RPW [22]. Other authors conclude that the failure of conservative treatment can be predicted to a certain extent by measuring the length of the tear and that a compromise >55% of the thickness of the tendon predicts the need for surgical treatment [6, 11].

At present, there is no case report in the literature similar to the one presented in this study, where a sharp injury mechanism with this degree of involvement is shown (at least 70%). RPW therapy was effective, with clinical follow-up and imaging results at 4 and 12 months, finding remission of the lesion, without symptoms of relapse.

Conclusion

RPW can be a good non-invasive therapeutic alternative in patellar tendon damage due to direct trauma with a sharp injury and in tendon involvement >55%, however, more studies are required in this regard.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the Journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

Conflicts of Interest: Nil. **Source of Support:** None.

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