

## Original article

## Platelet rich plasma for the management of tendinopathy of the Achilles tendon and plantar fasciitis

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**ABSTRACT. *Introduction:*** Non-surgical treatment of Achilles tendinopathies and plantar fasciitis has shown good results in up to 90% of cases. However, the remaining 10% of patients with these conditions represent a true challenge for the orthopedic surgeon. New technologies for the development of orthobiologic materials make it possible to use platelet-rich plasma (PRP) as an alternative to treat cases that have been refractory to prior treatment and that have a chronicity exceeding 12 months. ***Material and methods:*** Prospective, analytical study. Patients with diagnosis of Achilles tendinopathy, plantar fasciitis or both, with a course of more than 12 months, previously treated with non-surgical alternatives, without any clinical improvement. The AOFAS hindfoot scale was used, together with the Visual Analog Scale (VAS) for pain, and photographic documentation at 2, 4, 8 and 12 months after infiltration. A treatment program that included immobilization, NSAIDs, eccentric exercises for the Achilles-calcaneal-plantar system and strengthening of the sural triceps was established. The statistical analysis included measurements of the central trend and scatter with the SPSS 15. ***Results:*** A sample consisting of 10 patients (12 feet) that met the diagnostic and inclusion criteria was obtained. Mean age at the time of presentation was 43 years (range 23-56), with females being predominant (70%) and 50% laterality for

**RESUMEN. *Introducción:*** El tratamiento no quirúrgico de las tendinopatías de Aquiles y la fasciitis plantar ha mostrado buenos resultados hasta en 90% de los casos; sin embargo, el 10% restante de los pacientes con dichas patologías representan un verdadero reto para el ortopedista. Las nuevas tecnologías en el desarrollo de materiales ortobiológicos ofrecen como alternativa la utilización de plasma rico en plaquetas (PRP) para tratar los casos refractarios al tratamiento previo y cronicidad de más de 12 meses de evolución. ***Material y métodos:*** Estudio prospectivo, analítico. Pacientes con diagnóstico de tendinopatía de Aquiles, fasciitis plantar o ambos, evolución mayor a 12 meses, previamente tratados con alternativas no quirúrgicas y sin mejoría clínica. Se evaluó escala AOFAS para retropié, escala visual análoga del dolor (EVA) y documentación fotográfica a las 2, 4, 8 y 12 semanas posteriores a la infiltración. Se estableció un programa de tratamiento que incluye: inmovilización, utilización de AINES, ejercicios excéntricos para el sistema Aquiles-calcáneo-plantar y fortalecimiento de tríceps sural. Análisis estadístico mediante medidas de tendencia central y dispersión con SPSS 15. ***Resultados:*** Se obtuvo una muestra de 10 pacientes (12 pies) con los diagnósticos y criterios para su inclusión. La edad promedio de presentación fue de 43 años (rango 23-56), con predominio del sexo femenino (70%) y con una lateralidad del 50% para los pies dere-

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the right and left feet. The initial AOFAS score was 39 (range 28-68) and the VAS score was 9 (range 7-10). By week 16 the AOFAS score had increased to 97 (range 88-99) and the VAS score was 2 (range 1-4). All patients resumed independent gait. **Conclusion:** The use of PRP in patients with Achilles tendinopathy and plantar fasciitis is an effective and safe alternative for the management of patients with a poor response to conventional non-surgical treatment. Other non-surgical modalities are recommended besides PRP for the treatment of these patients to achieve appropriate results.

**Key words:** plasty, tendon, Achilles, fascitis, pain, foot, platelet.

chos e izquierdos. La puntuación AOFAS inicial fue de 39 puntos (rango 28-68) y EVA de 9 (rango 7-10). A las 16 semanas la puntuación AOFAS mejoró a 97 puntos (rango 88-99) y EVA a 2 (rango 1-4). Todos los pacientes recuperaron la marcha independiente. **Conclusión:** La utilización del PRP en pacientes con tendinopatía de Aquiles y fascitis plantar es una alternativa efectiva y segura para el manejo de pacientes sin buena respuesta al tratamiento no quirúrgico convencional. Se recomienda incluir otras modalidades no quirúrgicas además del uso de PRP en el tratamiento de este tipo de pacientes a fin de lograr un resultado favorable.

**Palabras clave:** plastia, tendon, Aquiles, fascitis, dolor, pie, plaquetas.

## Introduction

Tendons are structures of the musculoskeletal system that act as pulleys between the muscles and the bones allowing the movement of the joints they go across and they, therefore, play a fundamental role in locomotion. Due to the anatomical and histologic structure of tendons, their repair process is slow and uncertain.<sup>1</sup> There are numerous theories around the mechanism of injury of tendons; most of them revolve around a mechanical problem resulting from tendon overuse; other theories assume that the problems of hindfoot malalignment or the use of various chemicals like quinolones or corticoids favors microruptures, inflammation and, finally, the dysfunction of complete rupture of tendons.<sup>2-7</sup> The anatomical variant consisting of having short gemelli, which results in the inability to move the ankle beyond 90° with the knee in extension, has been associated with dysfunction of the achilleo-calcaneo-plantar system, and clinically presents as Achilles tendinopathy or plantar fasciitis.<sup>8-12</sup> In most cases various authors report cure rates as high as 90% in patients with alteration of such system with the conventional conservative measures; however, the remaining 10% may become a true challenge for the foot and ankle surgeon due to the scarce therapeutic options available and the unfavorable results, regardless of the treatment selected.

Platelet rich plasma (PRP), according to information from the literature, seems to provide good results in the treatment of soft tissue disorders, mainly muscular and tendon problems (*Table 1*).<sup>13</sup> Since this is a still recent orthopedic treatment and despite the fact that biomaterials have become popular, in the papers published on this topic one can only find case series and expert opinions. As a result of this, the authors decided to plan a treatment method for Achilles tendinopathies and plantar fasciitis refractory to initial treatment and with a course of more than one year. Treatment included PRP as well as other non-surgical measures with evidence of effectiveness in the treatment of the conditions mentioned, such as NSAIDs for acute pain, immobilization and extrinsic stretching exercises for the achilleo-calcaneo-plantar system. The purpose of all this is to offer an option that is halfway between traditional initial non-surgical treatment and the need to perform surgery, which usually includes bloody procedures and involves an important concomitant patient morbidity.

## Material and methods

A prospective analytical study (case series) was undertaken to prove the efficacy of platelet rich plasma (PRP)

**Table 1. Growth factors found in PRP.**

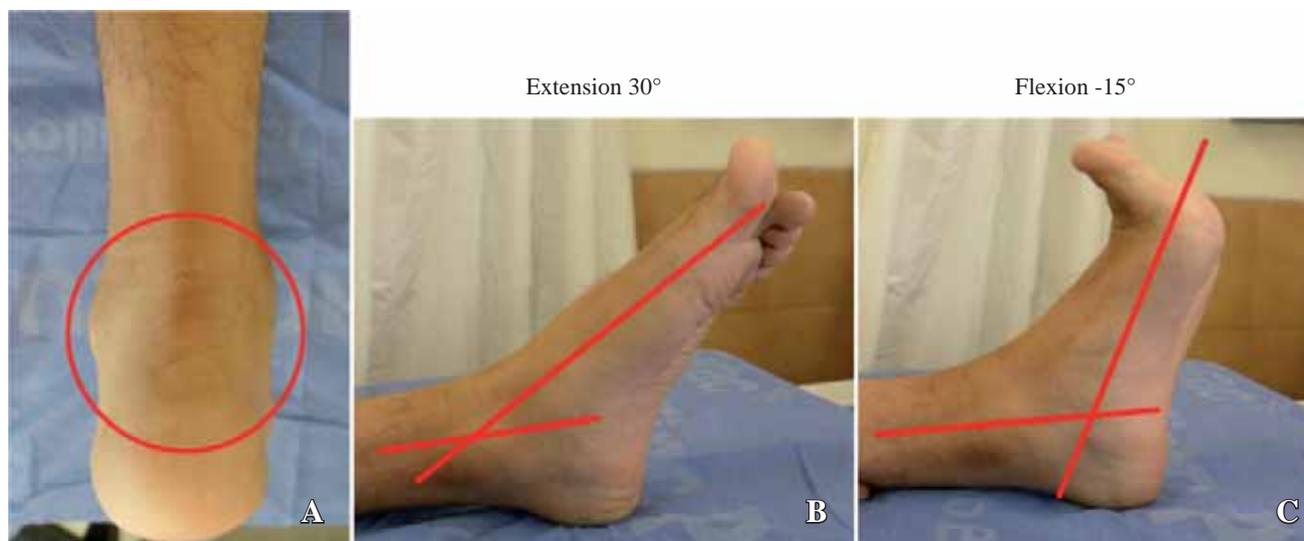
Growth factor	Source	Function
Platelet derived	Platelets	Stimulates cell replication, angiogenesis, mitogenic for fibroblasts
Vascular endothelial	Platelets	Angiogenesis
Transforming B1	Platelets	Regulates the balance between fibrosis and myocyte regeneration
Fibroblasts	Platelets	Myoblast proliferation, angiogenesis
Epidermal	Platelets	Proliferation of mesenchymal and epithelial cells, potentiation of other growth factors
Hepatocytes	Plasma	Angiogénesis, mitogénico, antifibrótico
Insulin-like type 1	Plasma	Stimulates myoblasts and fibroblasts, mediates skeletal muscle repair

infiltration for the treatment of Achilles tendinopathies and plantar fasciitis, combining it with other non-surgical therapeutic measures for which there is evidence in the literature. Patients included were those who presented at the Neuromuscular Deformities and Foot and Ankle Pathology Service, National Rehabilitation Institute, and were diagnosed with Achilles tendinopathy and/or plantar fasciitis between March and September, 2010, with a disease course of more than one year, who had received any treatment except for surgery and who continued to have pain.

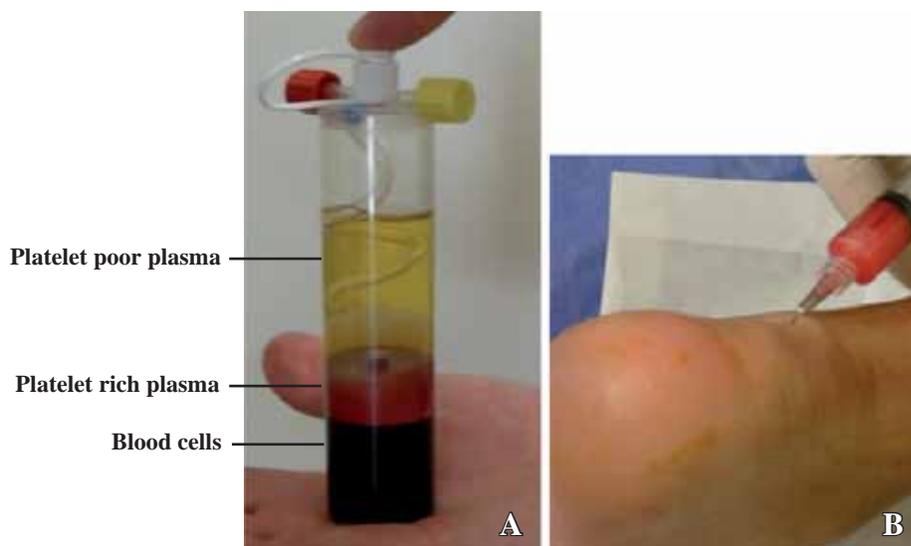
An initial assessment was performed with the AOFAS scale for the hindfoot and the visual analog scale (VAS) for pain. Sociodemographic data were recorded and patients received an informed consent form prepared *ex professo* for the procedure, which stated the importance of compliance with the proposed treatment (Figure 1).

A PRP infiltration was performed using the RECOVER™ system manufactured by Biomet, according to the provider's specifications. It was done at the office, after the administration of a local anesthetic. In the case of Achilles tendon pathologies, the infiltration was performed at the site of the lesion as determined clinically or based on previous imaging studies. In the case of plantar fasciitis, infiltration was performed with a medial approach locating the tuberosity of the calcaneus bone and applying the suspension in the attachment of the plantar fascia. A mean of 3 ml of the platelet concentrate was deposited in each case (Figure 2).

After the PRP infiltration, patients were instructed on complementary measures and on not lifting any weight with the extremity for two weeks, and a suropodal posterior immobilization brace was placed.



**Figure 1A.** Clinical appearance of a patient with Achilles tendinopathy. **B.** Full foot extension. **C.** Flexion limitation associated with contracture of the achilleo-calcaneo-plantar system.



**Figure 2A.** Appearance of platelet rich plasma after obtention. **B.** Infiltration is performed directly over the involved site according to the clinical assessment.

Hip and knee strengthening exercises for the immobilization period and thereafter were indicated to patients at the time of infiltration; stretching and strengthening exercises for the achilleo-calcaneo-plantar system were indicated for the entire follow-up period.

During the follow-up visits that took place at weeks 2, 4, 8, 12 and 16 after PRP infiltration the hindfoot AOFAS scale and the pain VAS were applied. The statistical analysis of the results was done with the SPSS 15 software and applying central trend and scatter measurements.

**Results**

The initial sample consisted of 11 patients (13 feet) with the above mentioned conditions. One patient was excluded from the series due to non-compliance with follow-up visits. The final sample consisted of 10 patients, two of them with bilateral pathology (12 feet). There were 7 females (70%) and 3 males (30%). Mean age was 43 years (range 23-56). The presentation of cases was the same for the right and left feet (50% each). Mean disease course was 16 months (range 12-26) and all patients had undergone some kind of previous non-surgical treatment that included rest, insoles, corticoid infiltrations or various rehabilitation protocols.

The initial diagnoses were as follows: plantar fasciitis in 8 cases (66%), Achilles tendinopathy in 3 cases (25%), and one case of mixed pathology (9%). The initial mean AOFAS score was 39 (range 28-68) and the VAS 9 (range 7-10). None of the patients could walk independently at the time of the first visit (*Chart 1*).

Patient follow-up results were generalized improvement in all cases at the time of removing the immobilization; the AOFAS scale score was over 60 points at 2 weeks. However, a generalized decrease was also seen in the AOFAS scale at follow-up week 4. This coincided with the time when patients began weight bearing upon tolerance and started eccentric exercises for stretching the Achilles tendon. From this moment on a progressive improvement was seen in the AOFAS scale in all patients until the end of the follow-up period. This same trend was observed, but conversely, in the VAS (*Chart 2*).

One of the patients with diagnosis of plantar fasciitis had early Complex regional pain syndrome two weeks after PRP infiltration. In this case we decided to remove the brace, provide treatment with immunomodulators and start passive movement of the foot and ankle upon tolerance. Pain subsided completely at 4 weeks and the patient could continue with treatment as was established in the initial management protocol.

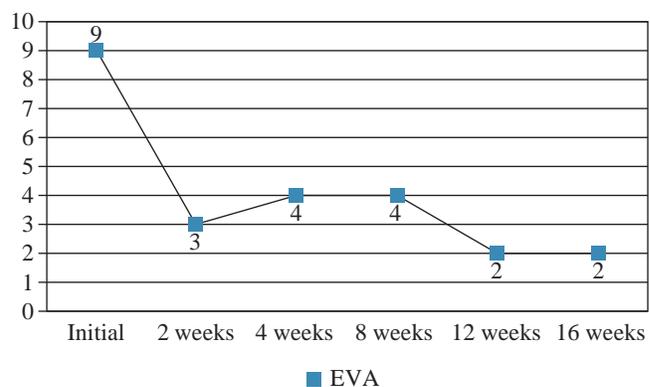
In two cases of patients with diagnosis of Achilles tendinopathy and associated Haglund deformity, it was necessary to perform surgical resection of the deformity and debridement of the retrocalcaneal space, as pain had recurred at 16 weeks, precisely when patients fully returned to activities of daily living and started using regular footwear. It was decided to perform exostectomy with a small incision (ap-

proximately 3 cm), parallel and lateral to the Achilles tendon above its distal attachment in the calcaneus bone. The Achilles tendon was not «swept». PRP was applied again when the procedure was completed, this time as a clot placed inside the surgical incision; then the usual treatment after this kind of intervention was followed.

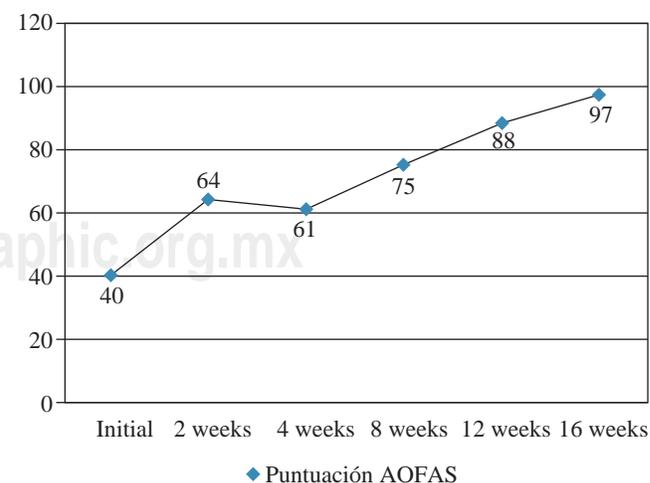
One patient with diagnosis of plantar fasciitis started having signs of peroneal tendinopathy 14 weeks after treatment, with pain and loss of strength in the corresponding muscle group. However, the patient reported the complaint as a «different pain» compared to the initial pain. At the end of the follow-up, at week 16, the mean AOFAS score was 97 points (range 88-99) and the VAS score was 2 points (range 1-4). All patients went back to independent and painless gait.

**Discussion**

Despite that initially PRP treatment for insertional or non-insertional tendinopathies appears to be promising, there are in fact no studies in world literature leading to



**Chart 1.** Evolution of the pain visual analog scale. Source: Direct collection n = 12.



**Chart 2.** Evolution of the AOFAS scale for the hindfoot.

making important recommendations within evidence based medicine. Moreover, the patient series that have been reported are small and have a short follow-up. In this study we have found good results treating patients with Achilles tendinopathy and/or plantar fasciitis who had been previously treated non-surgically for more than one year and had not had any improvement; however, we also found the above mentioned limits. Our patient series is small and the follow-up is only 4 months. Despite these limitations, it is interesting that the patients treated with PRP had different characteristics than the ones currently published, all of them had a disease course of more than one year, they had received multiple treatments, and all of them had assisted gait at the first visit, which reflects a series of complicated patients.

According to recent research, PRP is an important source of platelet growth factors which are effective for tissue regeneration. However, there are also published papers questioning the utility of the growth factors obtained and used with these techniques, given the proven short life span of the tissues where PRP is deposited.<sup>14</sup> Nevertheless, this time of exposure to growth factors is probably enough as trigger of a tissue repair cascade produced through them.

It is important to consider that the management protocol used in this patient series includes treatment guidelines additional to PRP, with previously published evidence of effectiveness and validated in world literature, such as NSAIDs for the management of acute pain, initial immobilization, and the inclusion of eccentric exercises to stretch the achilleo-calcaneo-plantar system.<sup>15-17</sup> The role of these and other combined non-surgical treatment modalities in achieving patient improvement should not be neglected.

A topic of discussion within the main international forums on foot and ankle surgery has been the role of short gastrocnemius muscles in the development of conditions like Achilles tendinopathy or plantar fasciitis.<sup>18,19</sup> This anatomical variant may be easily corroborated with the Silfverskjöld<sup>8</sup> test, and the frequency of the presence of short gemelli in patients with some type of dysfunction of the achilleo-calcaneo-plantar system. Future guidelines for the surgical treatment of these conditions will probably revolve around percutaneous lengthening or lengthening using small incisions in one of the gastrocnemius muscles. Samuel and Pierre Barouk have popularized the proximal lengthening of the medial gemellus with a minimal incision at the level of the popliteal fossa.<sup>20</sup> However, a cause-effect relation of these factors cannot be stated as, according to R. Viladot, this anatomical variant occurs frequently in the population, according to a study done in cadaveric calcanei. Therefore, short gemelli are rather a consequence of failed evolution resulting from a biomechanical mal adaptation of the achilleo-calcaneo-plantar system upon transitioning from a quadrupedal gait, with certain equinism, to a bipedal gait that causes an important tension in the system.<sup>21</sup> It is not possible to assure that the presence of short gemelli is itself a pathologic process.

Biomaterials, growth factors, bone marrow aspirate or cell cultures, among others, are novel options offering to

improve the results obtained by orthopedic surgeons with conventional techniques and should be considered only as adjuvants of comprehensive patient care. By no means do we intend to replace an appropriate diagnosis and a proper surgical indication with these elements. However, we do believe that there are tools that offer a prompter recovery and less morbidity of our patients. It is worthwhile to consider the advantages offered by biomaterials.

In this patient series we found encouraging results that motivate us to conduct subsequent research protocols with a higher evidence level to find out what is the exact role of growth factors in the treatment of conditions such as Achilles tendinopathies and plantar fasciitis.

## Conclusion

According to the results in our series, we believe that the use of PRP and combination therapy for the non-surgical management of patients with Achilles tendinopathy and plantar fasciitis is a good alternative prior to surgical treatment in cases that are complicated or refractory to initial treatment.

In cases with non-insertional Achilles tendinopathy with associated Haglund deformity we recommend surgical treatment (exostectomy) with the surgeon's technique of choice.

When the decision of surgery is made, PRP is a good adjuvant because it allows performing less bloody procedures, reduces the risk of patient morbidity, and contributes to prompt return of patients to activities of daily living.

It is very important to convince clients of the importance of treatment compliance, particularly concerning stretching exercises for the achilleo-calcaneo-plantar system, to achieve good results.

We need to know the results of series including more patients and with more stringent methodologic designs to determine the exact role that platelet growth factors play in the treatment of these conditions.

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