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ACHILLES TENDON RUPTURE AND PLATELET RICH PLASMA

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SUMMARY

Achilles tendon rupture is currently one of the most frequent injuries in athletes. Such rupture may be caused by a sudden dorsiflexion of the ankle, pushing off with the weight bearing forefoot while extending the knee or violent dorsiflexion of a plantar flexed foot. The treatment goal consists of restoring the normal tendon length and tension, as well as the function and strength of the gastrocnemius-soleus complex. The biological repair process can be enhanced in all stages of recovery with the use of PRP (Platelet Rich Plasma) without any side effects.

Introduction

Achilles tendon rupture is currently one of the most commonly encountered lesions in people who practice sports, affecting one athlete in 10000.

The athletic disciplines in which this injury is most frequently observed include football, basketball, handball and track and field. However, Achilles tendon rupture does not occur only in athletes, as it is also often found in spontaneous forms.

The rupture of the Achilles tendon is, in order of frequency, the third most common type of tendon rupture (Weiner and Lipscomb) [1], and is more common among male patients, with a male-female ratio of 6:1. The average age of patients with Achilles tendon rupture is between 30 and 50 years, with a peak at around 35 years of age.

The most frequent pathogenic mechanisms that determine tendon rupture include a sudden dorsiflexion of the ankle, pushing off with weight bearing forefoot while extending the knee, or violent dorsiflexion of a plantar flexed foot, as in a fall from height. The tendon can also rupture due to direct blunt trauma or open wound to the area.

Treatment goals for Achilles tendon ruptures include normalizing the muscle-tendon length and tension, and optimizing function and strength of the whole gastrocnemius-soleus complex. However, studies available on this injury are not in agreement on the best way to achieve these goals. Proponents of nonoperative treatment emphasize the higher incidence of complications such as deep infection, fistulae, skin necrosis and neurological lesions in patients treated surgically. However, proponents of surgical repair highlight the lower incidence of recurrence, greater force achievable after recovery, and a higher percentage of patients able to return to their habitual athletic activities. Tenorraphy is a treatment method that can be performed with open, mini-open (Achilon) or minimally invasive percutaneous (But-Griffith, Tenolig) surgical techniques.

However, the treatment of Achilles tendon rupture must be based, regardless of the

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method chosen, on the knowledge and understanding of the biological repair processes that can be implemented by the use of Platelet Rich Plasma (PRP) in patients treated surgically. This approach offers several advantages, enabling a faster recovery and reducing the chance of recurrence without any side effects [2].

Material and Methods

Between February 2008 and December 2011, 32 patients with Achilles tendon rupture were treated at our facility with non-absorbable end-to-end suture. In all patients, the time elapsed between rupture and surgery was two to four days. In 21 cases, PRP was used, and in one patient with a simultaneous bilateral rupture it was decided to apply the platelet gel only to the right limb for a comparative study (Figure 1, 2, 3, 4)

For the preparation of the platelet gel, the Biomet GPS III system was employed. This technique uses centrifugal force to separate blood components based on their relative density. Erythrocytes are denser and tend to settle to the bottom. The plasma, however, is less dense and floats in the top layer. The supernatant ("buffy coat") that contains the majority of platelets is located between the plasma and erythrocytes.

To obtain the platelet gel, 60 cc of blood was withdrawn from each patient, and 6 cc of PRP was derived from this sample with the GPS centrifugation process. Thrombin

Figure 1: Surgery in patient with simultaneous bilateral Achilles tendon rupture.

Figure 2: Another surgery phase in patient with simultaneous bilateral Achilles tendon rupture.

Figure 3: PRP prior to application to the lesion.

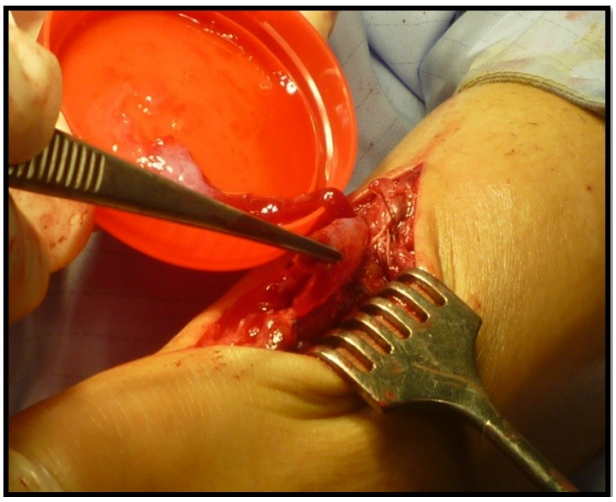

Figure 4: PRP implantation in the right limb of the patient with bilateral Achilles tendon rupture.

was then added to the platelet-rich plasma, and the resulting platelet gel was applied intratendinously following the tenorraphy, and the peritenon was carefully sutured (Figure 5).

During the post-operative period, patients followed a standard rehabilitation protocol that included an initial total rest phase with the duration of three weeks, during which only minor mobilization of the tibiotarsal joint was allowed.

From the 25th post-operative day, the patients were allowed to become more mobile while using a Walker brace and two elbow crutches; weight-bearing, active mobilization and rehabilitation in water were encouraged. At about 60 days after the operation, the brace was removed and walking without crutches was permitted to ensure a progressive functional recovery.

In all patients, response to treatment was evaluated from both a symptomatologic (VAS scale) as well as a functional point of view, using the VISA-A scale (Victorian Institute of Sports Assessment-Achilles), a valid and reliable index for evaluating the clinical severity of Achilles tendinopathy through the analysis of pain, applicable to both normal daily activities and sports.

Figure 5: The peritenon is carefully sutured after platelet gel application to ensure the growth factors remain in the lesion area

Results

In all patients who underwent tenorraphy complete functional recovery was achieved. In cases where the PRP approach was used, the recovery process was quicker, as evidenced by the fact that these patients regained mobility and returned to their habitual sports activities more rapidly. In the patient with bilateral rupture, the wound healed earlier and with better *restitutio ad integrum* in the right limb compared to the left one, as demonstrated by the far superior results from isokinetic, stabilometric and functional tests.

With regard to the painful physical symptoms, 45 days after surgery a complete remission was achieved in 17 of 21 patients treated with PRP and in the right limb of the patient with bilateral rupture, as evidenced by the VAS scale results. Reduction of pain was observed in the remaining 14 patients.

At a distance of 180 days from the surgery, the patients were assessed with the VISA-A questionnaire (with a range from 0 to 100) that evidenced a significantly better score in patients who underwent surgery with platelet gel application (81 ± 11 compared to 94 ± 3) and in the right limb of the patient with bilateral rupture (96 compared to 87). However, at the one-year check-up after surgery, the difference between the two groups was attenuated and functional recovery rates were almost superimposable (94 ± 2 compared with 96 ± 3).

Discussion

The process of tendon repair consists of three different stages: an inflammatory phase, a proliferative phase and a modeling phase.

All these stages of the regeneration process can be enhanced and improved by the application of PRP. The normal healing processes of tissues entail a complex cellular and molecular response, mediated by a wide range of growth factors and cytokines that are released by the plasma and the α-granules of platelets [3]. The application of platelet gel that releases directly in the lesion area factors such as TGF β (transforming growth factor-β), PDGF (platelet-derived growth factor), IGF (insulin-like growth factor) and vascular endothelial growth factor can therefore be used for modulation of cell activity in various stages of tissue regeneration. Anita and colleagues [4] suggest that the implantation

of autologous platelet-rich gel is useful in tendon injuries because it promotes cell proliferation and synthesis of important angiogenic factors. Kajikawa and colleagues [5] have confirmed that PRP stimulates the production of type-I collagen.
Furthermore, even more recent studies have demonstrated that platelet gel has an important role in reducing pain and in preventing infections [6].

Conclusion

In our opinion, the healing process should be reinforced, more than accelerated. In fact, to complete the process of protein synthesis fibroblasts still need about three weeks, before the formation of collagen and other protein constituents of connective tissue can take place. When degenerate tissue and poor biological reaction prevail, the application of PRP at an intratendinous level, bringing to the lesion site the biological media needed for the normal regeneration process, can be extremely useful in patients who have specific functional demands. This approach can ensure a more rapid functional recovery and reduce risk of relapse in athletes with limited additional cost.

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