Platelet-rich plasma in muscle injuries: A possible kind of treatment in regenerative sport traumatology

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Abstract

Muscle injuries are the most frequent cause to inability to sport exercises. The aim of any treatment is the return to the normal sport activity like before trauma. Many treatments have been purposed in the literature: recently the use of Platelet-Rich Plasma (PRP) has been described with good results. In this review all studies searched electronically using the PubMed database have been analyzed to discovery the validity, modality and efficiency of PRP injections in muscle injuries. In literature few studies are published and all of them demonstrate good results but timing, quantity, frequency and how use a PRP injection protocol remain important questions.

Introduction

Muscle injuries are one of the commonest types of injuries occurring in athletes. They are about 31% of all injuries in elite football (soccer) [1] and often these injuries results in loss of training and competition time. Thigh muscle injuries represent those most commonly diagnosed in track and field athletes (16%) but have also been documented in team sports like rugby (10.4%), basketball (17.7%) and American football (46%/22% practice/games) [2]. A correct evaluation, diagnosis and therapy of the index muscle disorder is important for a correct choose of treatment: the therapeutic approach is based on the degree of injury [3].

In the simplest cases, in which the myofibrillar architecture is not involved, the treatment is mainly represented by RICE, non-steroidal anti-inflammatory drugs (NSAIDs) and physical therapy (with active and passive modalities). In more serious cases, where there is also a miotendinous side involvement, the treatment of choice is surgery. However, in all cases rarely reaches a restitution ad integrum of damaged tissue [4] and this is the reason that drove the search to experience with new application techniques of tissue biology [5].

Recently, autologous platelet-rich plasma (PRP) injection has gained a lot of attention in the treatment of sports injuries including muscle injury. The rationale of PRP use is the belief that the additional Growth Factors (GFs) released by platelets augment the natural healing process [6]. Despite its increasing popularity as a treatment for muscle injuries there is a growing debate regarding PRP clinical efficacy [7,8].

Objective of this systematic review is to evaluate the evidence-based medicine about PRP infiltration in muscle injuries with a computerized literature search, with citation tracking and hand searching for original studies to assess the effect of this kind of treatment.

Materials and methods

All studies were searched electronically using the following PubMed database. Published systematic reviews about PRP injections were used as a source of randomized controlled trials. Peer-reviewed published articles until December 2012 were used; only articles published in English were considered. The titles and abstracts of all studies retrieved from the search were reviewed following criteria for study selection. The outcomes extracted from the selected study were not combined and re-analysed due to the nature of this qualitative systematic review. The Physiotherapy Evidence Database Scale (PEDro) for randomized controlled trials has been used: a PEDro score of =6 was considered to represent a high quality study, whereas a score of =5 represented a low quality study.

Results

The search identified 932 potential articles from the databases search but a lot of them were excluded because the studies were not on autologous PRP and muscle injury. Of the 22 full-text articles retrieved for further evaluation, only 4 articles were included in the final qualitative synthesis. The remaining 37 articles were excluded because 35 of these articles were review articles (including systematic reviews) and the remaining 2 were case reports.

Our research had found only one human study (Wright-Carpenter T et al. [9], published in 2004 on International Journal of Sport Medicine), a pilot controlled trial conducted considering professional sportsmen with moderate strains, and three animal / laboratory studies (another study of Wright-Carpenter T et al. [10], published in 2004 on International Journal of Sport Medicine; Hammon JW et al. [11], published in 2009 on American Journal of Sport Medicine; Gigante A et al. [12], published in 2012 on Journal of Biological Regulators and Homeostatic Agents) (Table 1).
Table 1. Our research on the effects of PRP therapy after muscle injuries

| Object of study                  | Studies                              | Outcome measurements                                                    | Groups of study                  | Results                                                                 |
|---------------------------------|--------------------------------------|------------------------------------------------------------------------|----------------------------------|------------------------------------------------------------------------|
| Professional sportsmen with a moderate strains | Wright-Carpenter T et al. (2004) Int J Sports Med 25: 588–593 | Mean recovery time to resume full sporting activity and regression of muscle edema and bleeding with MRI | PRP infiltration group compared to no treatment | A shorter mean recovery time and a faster regression of edema/bleeding in PRP infiltration group. |
| Animal / Laboratory study       | Wright-Carpenter T et al. (2004) Int J Sports Med 25: 582–587 | Speed and diameter of the regenerated myofibers after one week of mice gastrocnemius muscles injuries | PRP infiltrations compared to Actovecin/Trumaecel treatment | A faster recovery of injured myofibers with a bigger diameter in PRP infiltration group |
| Hammond JW et al. (2009) Am J Sports Med 37: 1135–1142 | Residual contractile function after rats tibialis anterior muscles injured | PRP infiltration group, PPP infiltration group as a sham treatment, no treatment group | A better contractile function in PRP infiltration group |
| Gigante A et al. (2012) J Biol Regul Homeost Agents 26: 475–484 | Muscle regeneration with an histological, immunohistochemical and histomorphometric analyses of rats longissimus-dorsi muscles injuries | PRFM infiltration group compared to no treatment | A better muscle regeneration, an increase in neovascularization and a slight reduction of fibrosis in PRFM infiltration group |

Discussion

There are many kinds of treatment to speed muscle healing: the combination of Traumeel S, Actovegin and local anaesthetic injection into injured muscle is very popular in Europe, despite the fact that there is no good clinical evidence of efficacy and little theoretical scientific basis [13]. About PRP, the GFs are provided in physiological proportions with the hope this will accelerate healing and lead to a balance of proliferative and inhibitory effects. Although this has theoretical and basic science underpinnings there has been little published quality research on the use of PRP in muscle: in fact in our research we have found a few study, especially in human muscle. In only one study conducted in sportsmen [9] the diagnosis of injury was based with a magnetic resonance imaging (MRI). The PRP-infiltration protocol was intralesional injection of 2.5 ml autologous conditioned serum (ACS), combined with 2.5 ml of saline, through palpation of the affected area, started two days after diagnosis and repeated every second day until full recovery. The main outcome measured was the time required to resume full sporting activities and the return to full sporting activities. The mean recovery time for participants in the group of PRP infiltration (16.6 days) was significantly shorter compared to the control group (22.3 days). In addition, MRI scans taken at 16 days in both groups demonstrated faster regression of the edema/bleeding in the PRP infiltration group. The number of professional sportsmen are small (11) with a heterogeneous variety of muscle strains and there was no true ‘control’ group, as the ‘control group’ had been treated with PRP interventions on acute muscle injuries are needed to establish the effectiveness, indications and protocols.

References

1. Ekstrand J, Hägglund M, Waldén M (2011) Epidemiology of muscle injuries in professional football (soccer). Am J Sports Med 39: 1226–1232. [Crossref]
2. Mueller-Wohlfahrt HW, Haensel L, Mitboeker K, Ekstrand J, English B, et al. (2012) Terminology and Classification of Muscle Injuries in Sport: A Consensus Statement. Br J Sports Med 47: 342–350. [Crossref]
3. Ramos LA, de Carvalho RT, Abdalla RJ, Ingham SJ (2015) Surgical treatment for muscle injuries. Curr Rev Musculoskelet Med 8: 188–192. [Crossref]
4. Järvinen TA, Järvinen TL, Kääriäinen M, Kalimo H, Järvinen M (2005) Muscle injuries: biology and treatment. Am J Sports Med 33: 745–764. [Crossref]
5. Turner NJ, Badyak SF (2013) Biologic scaffolds for musculoskeletal soft tissue repair. Eur Cell Mater 25: 130–143. [Crossref]
6. Moraes VV, Lenza M, Tamsuki MJ, Falappa F, Bellotti FC (2013) Platelet-rich therapies for musculoskeletal soft tissue injuries. Cochrane Database Syst Rev 12: CD010071. [Crossref]
7. Mei-Dan O, Lippi G, Sánchez M, Andia I, Maffulli N (2010) Autologous platelet-rich plasma: a revolution in soft tissue sports injury management? *Phys Sportsmed* 38: 127-135. [Crossref]

8. Schwarz AA (2009) Promising Treatment for Athletes, in Blood. The New York Times, New York, NY.

9. Wright-Carpenter T, Klein P, Schäferhoff P, Appell HJ, Mir LM, et al. (2004) Treatment of muscle injuries by local administration of autologous conditioned serum: a pilot study on sportsmen with muscle strains. *Int J Sports Med* 25: 588-593. [Crossref]

10. Wright-Carpenter T, Opolon P, Appell HJ, Meijer H, Wehling P, et al. (2004) Treatment of muscle injuries by local administration of autologous conditioned serum: animal experiments using a muscle contusion model. *Int J Sports Med* 25: 582-587. [Crossref]

11. Hammond JW, Hinton RY, Curl LA, Muriel JM, Lovering RM (2009) Use of autologous platelet-rich plasma to treat muscle strain injuries. *Am J Sports Med* 37: 1135-1142. [Crossref]

12. Gigante A, Del Torto M, Manzotti S, Cianforlini M, Busilacchi A, et al. (2012) Platelet rich fibrin matrix effects on skeletal muscle lesions: An experimental study. *J Biol Regul Homeost Agents* 26: 475-484. [Crossref]

13. Orchard JW, Best TM, Mueller-Wohlfahrt HW, Hunter G, Hamilton BH, et al. (2008) The early management of muscle strains in the elite athlete: best practice in a world with a limited evidence basis. *Br J Sports Med* 42: 158-159. [Crossref]

14. Menetrey J, Kasemkijwattana C, Day CS, Bosch P, Vogt M, et al. (2000) Growth factors improve muscle healing in vivo. *J Bone Joint Surg Br* 82: 131-137. [Crossref]