Tendons et PRP

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PRP & tendons

- Tendinopathies ≃ ***30%*** lésions musculosquelettiques
- Tendon = index métabolique ***bas***

- PRP → libération ***facteurs de croissance*** → proliferation cellulaire, synthèse de collagène, stimulation de l'angiogénèse (**Anitua** et al, *Cell Prolif 2009*; **Bosch** et al, *Scand J Med Sci Sports 2011*; **Kaux** et al, *Wound Repair Regen 2012*)
- Application ***charge mécanique*** nécessaire pour «guider» la cicatrisation tendineuse (**Virchenko** et al, *Acta Orthop 2006*; **Kaux** et al, *J Orthop Res 2012*)

Effects of platelet-rich plasma (PRP) on the healing of Achilles tendons of rats

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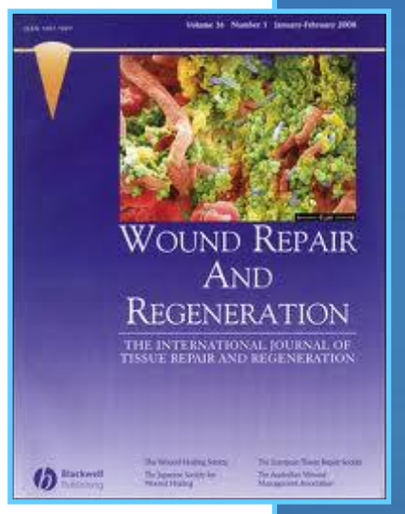

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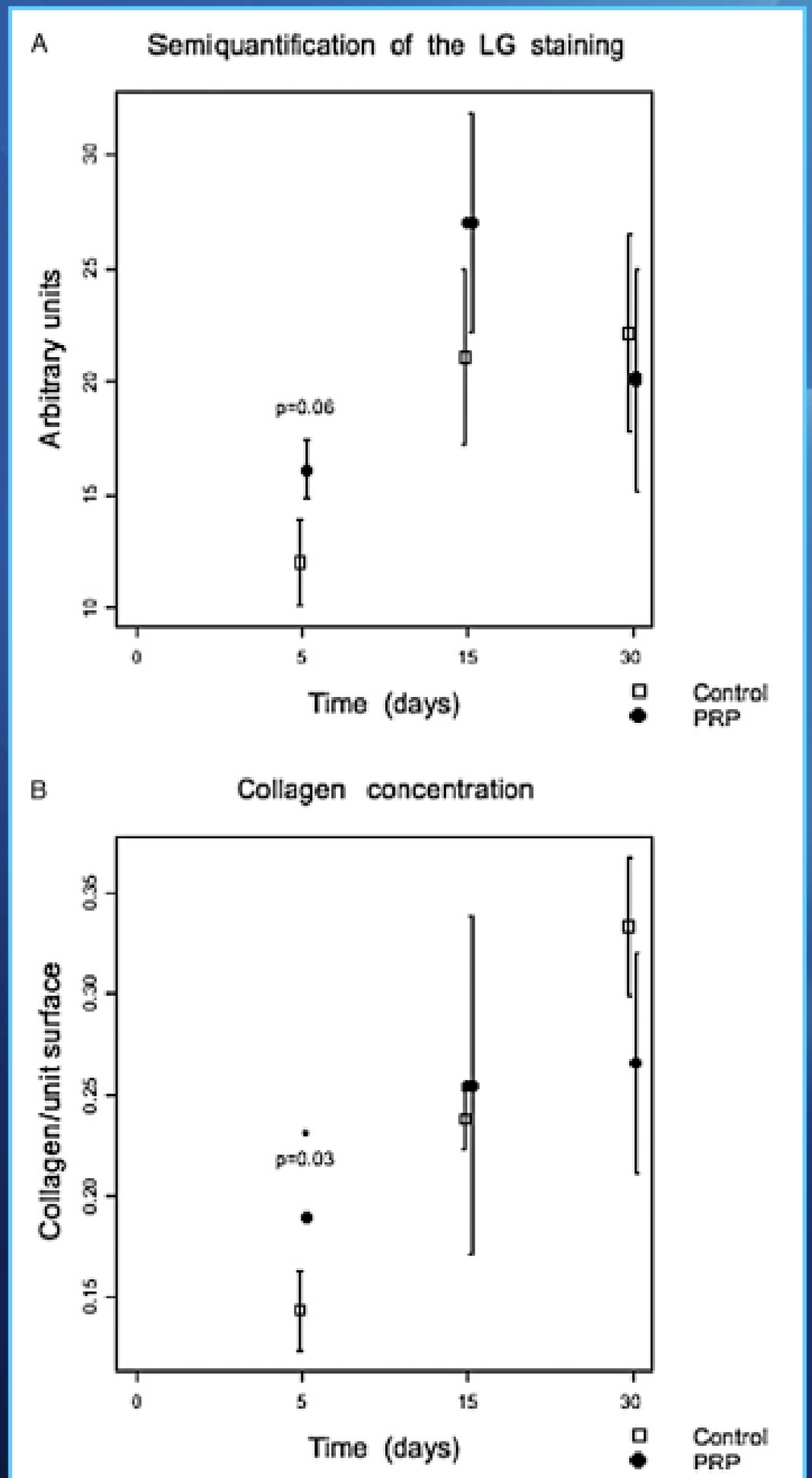
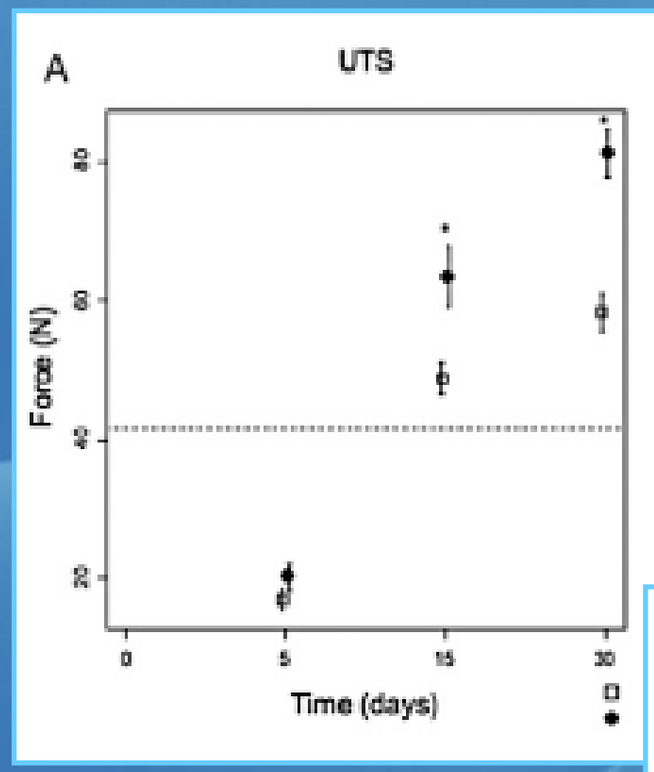
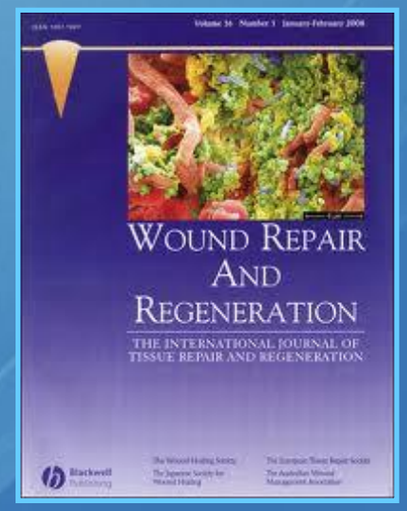
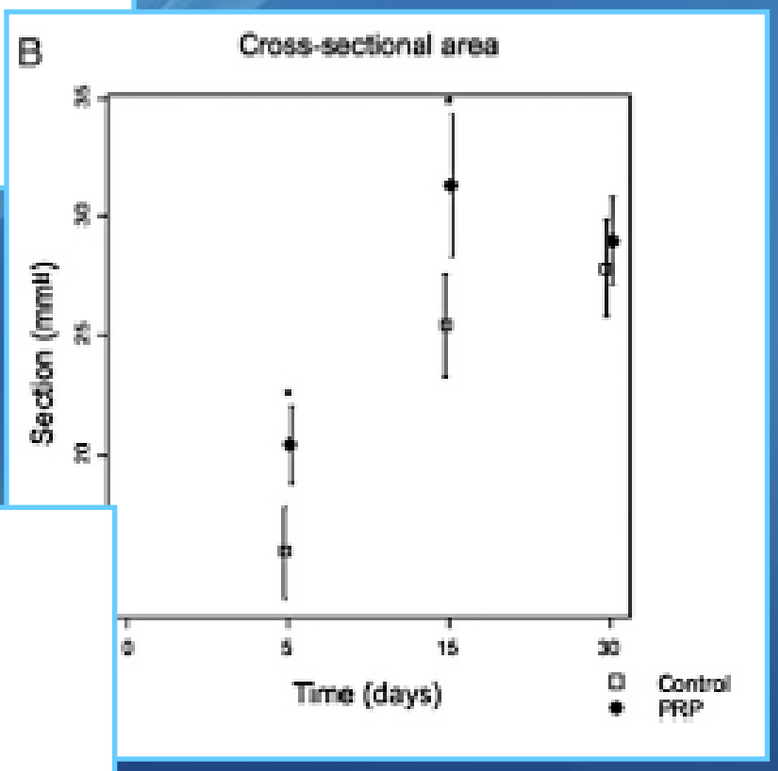
ABSTRACT

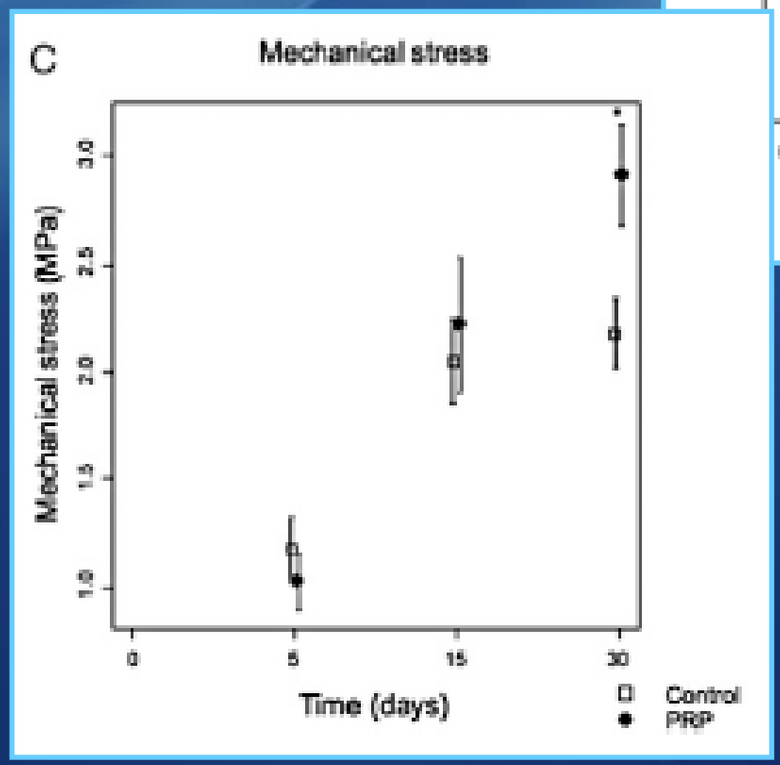
Platelet-rich plasma (PRP) contains growth factors involved in the tissular healing process. The aim of the study was to determine if an injection of PRP could improve the healing of sectioned Achilles tendons of rats. After surgery, rats received an injection of PRP ($n = 60$) or a physiological solution ($n = 60$) in situ. After 5, 15, and 30 days, 20 rats of both groups were euthanized and 15 collected tendons were submitted to a biomechanical test using cryo-jaws before performing transcriptomic analyses. Histological and biochemical analyses were performed on the five remaining tendons in each group. Tendons in the PRP group were more resistant to rupture at 15 and 30 days. The mechanical stress was significantly increased in tendons of the PRP group at day 30. Histological analysis showed a precocious deposition of fibrillar collagen at day 5 confirmed by a biochemical measurement. The expression of tenomodulin was significantly higher at day 5. The messenger RNA levels of type III collagen, matrix metalloproteinases 2, 3, and 9, were similar in the two groups at all time points, whereas type I collagen was significantly increased at day 30 in the PRP group. In conclusion, an injection of PRP in sectioned rat Achilles tendon influences the early phase of tendon healing and results in an ultimately stronger mechanical resistance.


A
Semiquantification of the LG staining
Arbitrary units
10
15
20
25
30
p=0.06
0
5
15
30
Time (days)
Control
PRP
B
Collagen concentration
Collagen/unit surface
0.15
0.20
0.25
0.30
0.35
p=0.03
0
5
15
30
Time (days)
Control
PRP


A
UTS
Force (N)
20
40
60
80
0
5
15
30
Time (days)


WOUND REPAIR
AND
REGENERATION
THE INTERNATIONAL JOURNAL OF
TISSUE REPAIR AND REGENERATION

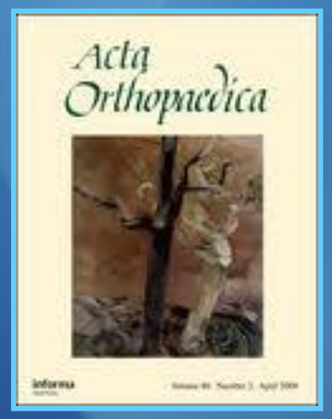

B
Cross-sectional area
Section (mm²)
20
25
30
35
0
5
15
30
Time (days)
Control
PRP


C
Mechanical stress
Mechanical stress (MPa)
1.0
1.5
2.0
2.5
3.0
0
5
15
30
Time (days)
Control
PRP

How can one platelet injection after tendon injury lead to a stronger tendon after 4 weeks?

Interplay between early regeneration and mechanical stimulation

Olena Virchenko and Per Aspenberg



Background Mechanical stimulation improves the repair of ruptured tendons. Injection of a platelet concentrate (platelet-rich plasma, PRP) can also improve repair in several animal models. In a rat Achilles tendon transection model, 1 postoperative injection resulted in increased strength after 4 weeks. Considering the short half-lives of factors released by platelets, this very late effect calls for an explanation.

Methods We studied the effects of platelets on Achilles tendon regenerates in rats 3, 5 and 14 days after transection. The tendons were either unloaded by *Botulinum* toxin A (Botox) injections into the calf muscles, or mechanically stimulated in activity cages. No Botox injections and ordinary cages, respectively, served as controls. Repair was evaluated by tensile testing.

Results At 14 days, unloading (with Botox) abolished any effect of the platelets and reduced the mechanical properties of the repair tissue to less than half of normal. Thus, some mechanical stimulation is a prerequisite for the effect of platelets at 14 days. Without Botox, both activity and platelets increased repair independently of each other. However, at 3 and 5 days, platelets improved the mechanical properties in Botox-treated rats.

Interpretation Platelets influence only the early phases of regeneration, but this allows mechanical stimulation to start driving neo-tendon development at an earlier time point, which kept it constantly ahead of the controls.

Eccentric Training Improves Tendon Biomechanical Properties: A Rat Model

Jean-François Kaux,[1] Pierre Drion,[2] Vincent Libertiaux,[3] Alain Colige,[4] Audrey Hoffmann,[4] Betty Nusgens,[4] Benoît Besançon,[1] Bénédicte Forthomme,[1] Caroline Le Goff,[5] Rachel Franzen,[6] Jean-Olivier Defraigne,[7] Serge Cescotto,[3] Markus Rickert,[8] Jean-Michel Crielaard,[1] Jean-Louis Croisier[1]

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ABSTRACT: The treatment of choice for tendinopathies is eccentric reeducation. Although the clinical results appear favorable, the biomechanical changes to the tissue are not yet clear. Even if the mechanotransduction theory is commonly accepted, the physiology of tendons is not clearly understood. We aimed to better define the biomechanical and histological changes that affect healthy tendon after eccentric and concentric training. This study compared the effects of two methods of training (eccentric [E] training and concentric [C] training) with untrained (U) rats. The animals were trained over a period of 5 weeks. The tricipital, patellar, and Achilles tendons were removed, measured and a tensile test until failure was performed. A histological analysis (hematoxylin and eosin and Masson's trichrome stains) was also realized. There was a significant increase in the rupture force of the patellar and tricipital tendons between the U and E groups. The tricipital tendons in the control group presented a significantly smaller cross-sectional area than the E- and C-trained groups, but none was constated between E and C groups. No significant difference was observed for the mechanical stress between the three groups for all three tendons. Histological studies demonstrated the development of a greater number of blood vessels and a larger quantity of collagen in the E group. The mechanical properties of tendons in rats improve after specific training, especially following eccentric training. Our results partly explained how mechanical loading, especially in eccentric mode, could improve the healing of tendon. J Orthop Res

Keywords: tendon; eccentric; concentric; rat

PRP & tendons

- Tendinopathies ***chroniques*** (>3 mois)
- (Ré)Initialisation d'une ***réaction inflammatoire*** aiguë
- ***Pas*** pour tendinites ***aiguës*** ou ténosynovites
- ***Pas*** indiqué si ***conflit*** mécanique

Epicondylites

Treatment of Chronic Elbow Tendinosis With Buffered Platelet-Rich Plasma

Allan Mishra,* MD, and Terri Pavelko, PAC, PT
From the Department of Orthopedic Surgery, Menlo Medical Clinic, Stanford University Medical Center, Menlo Park, California

Background: Elbow epicondylar tendinosis is a common problem that usually resolves with nonoperative treatments. When these measures fail, however, patients are interested in an alternative to surgical intervention.

Hypothesis: Treatment of chronic severe elbow tendinosis with buffered platelet-rich plasma will reduce pain and increase function in patients considering surgery for their problem.

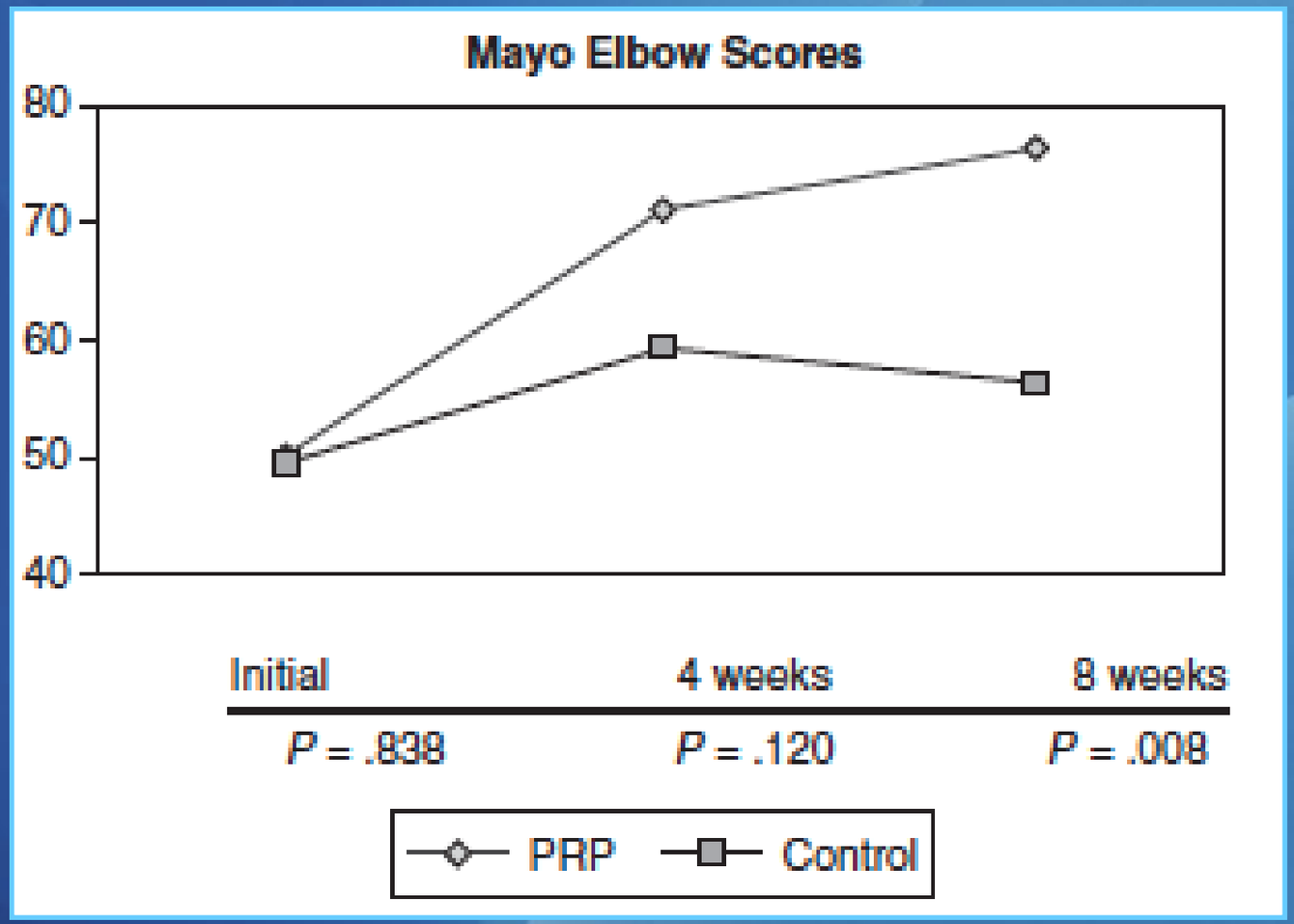
Study Design: Cohort study; Level of evidence, 2.

Methods: One hundred forty patients with elbow epicondylar pain were evaluated in this study. All these patients were initially given a standardized physical therapy protocol and a variety of other nonoperative treatments. Twenty of these patients had significant persistent pain for a mean of 15 months (mean, 82 of 100; range, 60-100 of 100 on a visual analog pain scale), despite these interventions. All patients were considering surgery. This cohort of patients who had failed nonoperative treatment was then given either a single percutaneous injection of platelet-rich plasma (active group, n = 15) or bupivacaine (control group, n = 5).

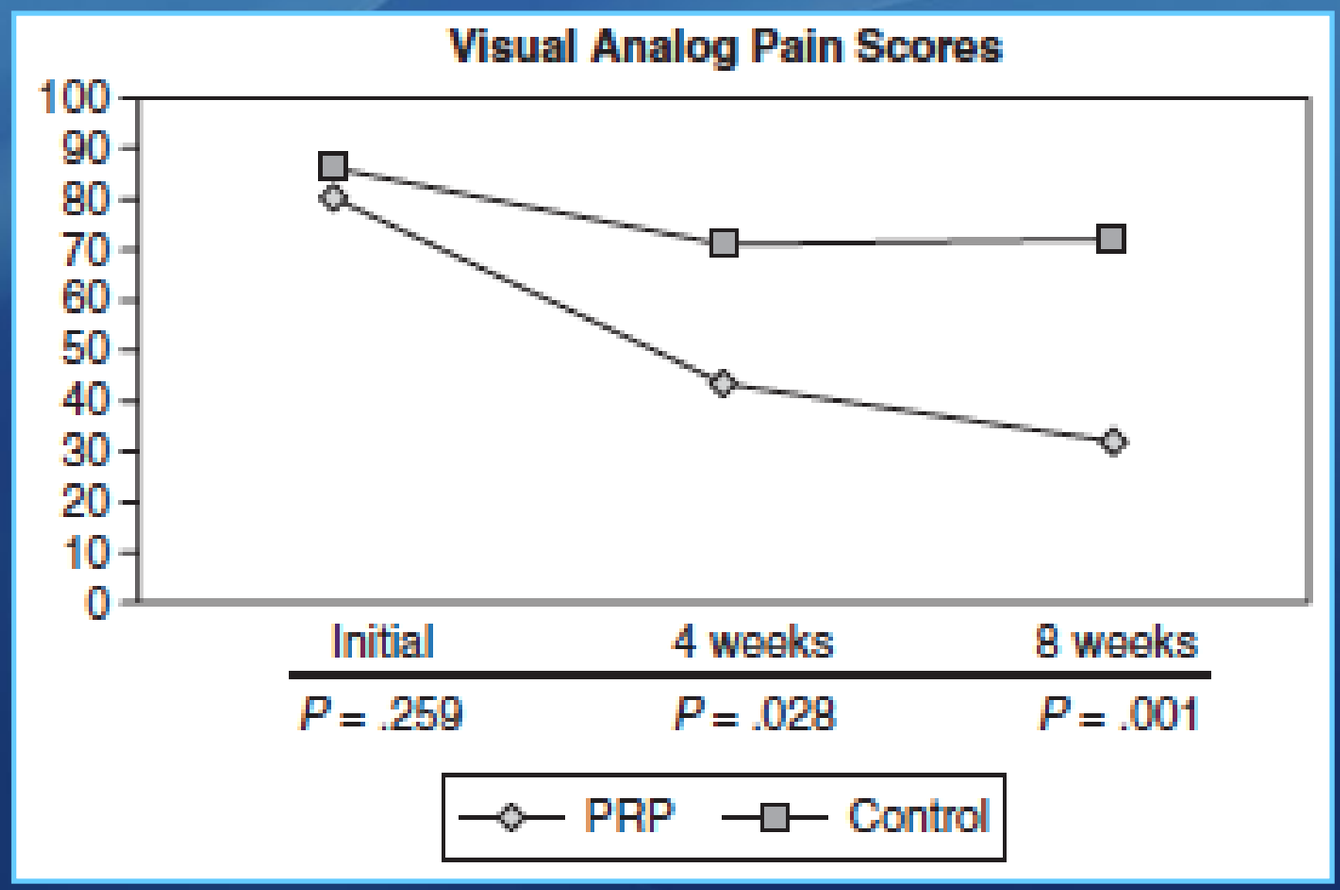
Results: Eight weeks after the treatment, the platelet-rich plasma patients noted 60% improvement in their visual analog pain scores versus 16% improvement in control patients ($P = .001$). Sixty percent (3 of 5) of the control subjects withdrew or sought other treatments after the 8-week period, preventing further direct analysis. Therefore, only the patients treated with platelet-rich plasma were available for continued evaluation. At 6 months, the patients treated with platelet-rich plasma noted 81% improvement in their visual analog pain scores ($P = .0001$). At final follow-up (mean, 25.6 months; range, 12-38 months), the platelet-rich plasma patients reported 93% reduction in pain compared with before the treatment ($P < .0001$).

Conclusion: Treatment of patients with chronic elbow tendinosis with buffered platelet-rich plasma reduced pain significantly in this pilot investigation. Further evaluation of this novel treatment is warranted. Finally, platelet-rich plasma should be considered before surgical intervention.

Keywords: platelet-rich plasma (PRP); tennis elbow; lateral epicondylitis; tendonitis; tendinosis


Mayo Elbow Scores
80
70
60
50
40
Initial
4 weeks
8 weeks
P = .838
P = .120
P = .008
PRP
Control


The American Journal of
Sports
Medicine


Visual Analog Pain Scores
100
90
80
70
60
50
40
30
20
10
0
Initial
4 weeks
8 weeks
P = .259
P = .028
P = .001
PRP
Control

Positive Effect of an Autologous Platelet Concentrate in Lateral Epicondylitis in a Double-Blind Randomized Controlled Trial

Platelet-Rich Plasma Versus Corticosteroid Injection With a 1-Year Follow-up

Joost C. Peerbooms,* MD, Jordi Sluimer,† MD, Daniël J. Bruijn,* PhD, and Taco Gosens,†‡ PhD
*From the *Department of Orthopaedic Surgery, HAGA Hospital, The Hague, Netherlands, and †Department of Orthopaedic Surgery, St Elisabeth Hospital, Tilburg, Netherlands*

Background: Platelet-rich plasma (PRP) has shown to be a general stimulation for repair.

Purpose: To determine the effectiveness of PRP compared with corticosteroid injections in patients with chronic lateral epicondylitis.

Study Design: Randomized controlled trial; Level of evidence, 1.

Patients: The trial was conducted in 2 teaching hospitals in the Netherlands. One hundred patients with chronic lateral epicondylitis were randomly assigned in the PRP group (n = 51) or the corticosteroid group (n = 49). A central computer system carried out randomization and allocation to the trial group. Patients were randomized to receive either a corticosteroid injection or an autologous platelet concentrate injection through a peppering technique. The primary analysis included visual analog scores and DASH Outcome Measure scores (DASH: Disabilities of the Arm, Shoulder, and Hand).

Results: Successful treatment was defined as more than a 25% reduction in visual analog score or DASH score without a reintervention after 1 year. The results showed that, according to the visual analog scores, 24 of the 49 patients (49%) in the corticosteroid group and 37 of the 51 patients (73%) in the PRP group were successful, which was significantly different ($P < .001$). Furthermore, according to the DASH scores, 25 of the 49 patients (51%) in the corticosteroid group and 37 of the 51 patients (73%) in the PRP group were successful, which was also significantly different ($P = .005$). The corticosteroid group was better initially and then declined, whereas the PRP group progressively improved.

Conclusion: Treatment of patients with chronic lateral epicondylitis with PRP reduces pain and significantly increases function, exceeding the effect of corticosteroid injection. Future decisions for application of the PRP for lateral epicondylitis should be confirmed by further follow-up from this trial and should take into account possible costs and harms as well as benefits.

Keywords: lateral epicondylitis; platelet rich plasma; corticosteroids; pain; function

Platelet-rich plasma for the treatment of lateral epicondylitis: sonographic assessment of tendon morphology and vascularity (pilot study)

Salma Chaudhury · Mauricio de La Lama · Ronald S. Adler · Lawrence V. Gulotta · Brendan Skonieczki · Anthony Chang · Peter Moley · Frank Cordasco · Jo Hannafin · Stephen Fealy

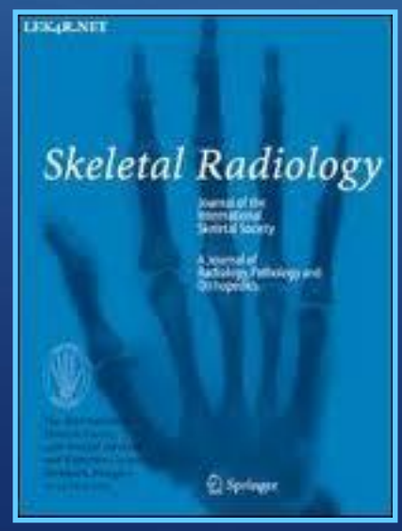
Abstract

Objective To investigate the efficacy of using contrast-enhanced ultrasound to assess the relationship of altered vascularity and tendon morphology following injection of platelet-rich plasma (PRP) for lateral epicondylitis.

Materials and methods This study prospectively evaluated six patients who had a baseline ultrasound confirming tendinosis of the common extensor tendon. Patients received a single 3-ml PRP injection under ultrasound guidance. Gray-scale images of the injected elbow were obtained at baseline and were repeated at 1 and 6 months after injection. DEFINITY® contrast was also injected after by 2 sets of wrist-extension exercises in order to obtain contrast-enhanced images of the elbow. Qualitative and quantitative analyses of the level of enhancement to the regions of interest were performed using off-line quantitative analysis software.

Results All patients had either moderate or severe common extensor tendinosis as determined on clinical examination and baseline imaging. Five patients demonstrated improved tendon morphology using ultrasound imaging 6 months after PRP injection (one patient was lost to follow-up). At baseline, there was evidence of increased vascularity at the myotendinous junction (MT) of the common extensor tendon when compared to its footprint (FP). There was a trend towards no change in FP vascularity between baseline and 6 months (p=0.062) and between 1 and 6 months (p=0.288). There was a trend for increased vascularity to the MT region from baseline to 6 months (p=0.433) and from 1 to 6 months (p=0.783).

Conclusions Contrast-enhanced ultrasound provides a sensitive method the display alterations in vascularity in the common extensor tendon of the elbow. PRP therapy for lateral epicondylitis can improve extensor tendon morphology. Corresponding increased extensor tendon FP vascularity, however, was not seen. There is a trend for increased vascularity at the MT up to 6 months following PRP injection, based on limited pilot data.



Platelet-Rich Plasma Versus Autologous Whole Blood for the Treatment of Chronic Lateral Elbow Epicondylitis

A Randomized Controlled Clinical Trial

Christos Thanasas,*† MD, George Papadimitriou,‡ MD, Charalambos Charalambidis,‡ MD, Ilias Paraskevopoulos,‡ MD, and Athanasios Papanikolaou,‡ MD, PhD
Investigation performed at the Department of Orthopaedic Surgery, Red Cross Hospital, Athens, Greece

Background: Chronic lateral elbow epicondylitis is a tendinosis with angiofibrolastic degeneration of the wrist extensors' origin. Healing of this lesion is reported with the use of autologous blood as well as with platelet-rich plasma (PRP).

Purpose: A comparative study of these 2 treatments was conducted in an effort to investigate the possible advantages of PRP.

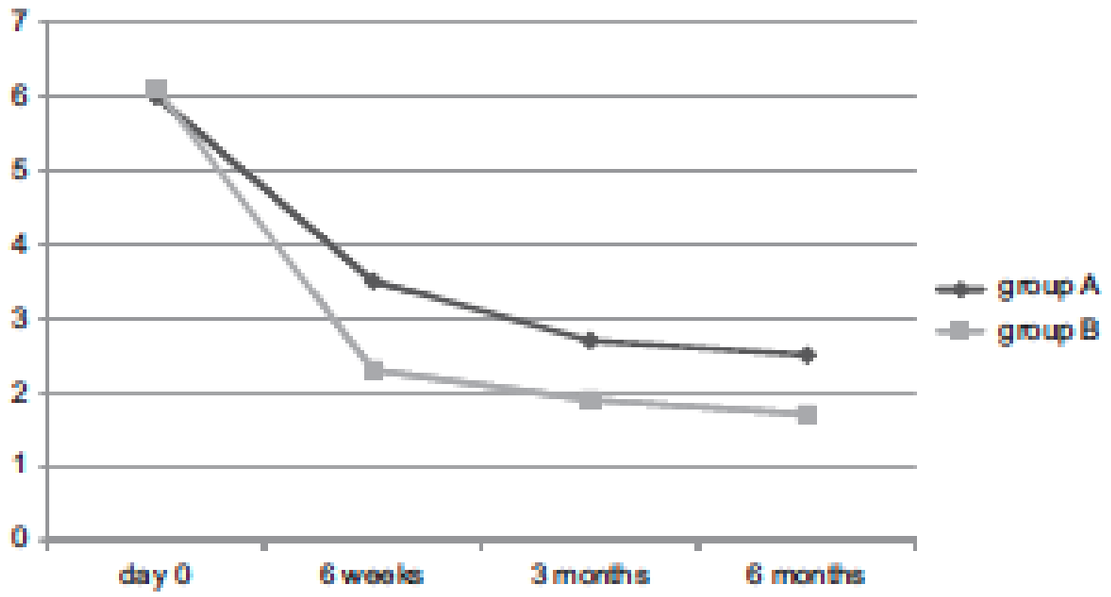
Study Design: Randomized controlled trial; Level of evidence, 1.

Methods: Twenty-eight patients were divided equally into 2 groups, after blocked randomization. Group A was treated with a single injection of 3 mL of autologous blood and group B with 3 mL of PRP under ultrasound guidance. A standardized program of eccentric muscle strengthening was followed by all patients in both groups. Evaluation using a pain visual analog scale (VAS) and Liverpool elbow score was performed at 6 weeks, 3 months, and 6 months.

Results: The VAS score improvement was larger in group B at every follow-up interval but the difference was statistically significant only at 6 weeks, when mean improvement was 3.8 points (95% confidence interval [CI], 3.1-4.5) in group B (61.47% improvement) and 2.5 points (95% CI, 1.9-3.1) in group A (41.6% improvement) ($P < .05$). No statistically significant difference was noted between groups regarding Liverpool elbow score.

Conclusion: Regarding pain reduction, PRP treatment seems to be an effective treatment for chronic lateral elbow epicondylitis and superior to autologous blood in the short term. Defining details of indications, best PRP concentration, number and time of injections, as well as rehabilitation protocol might increase the method's effectiveness. Additionally, the possibility of cost reduction of the method might justify the use of PRP over autologous whole blood for chronic or refractory tennis elbow.

Keywords: lateral elbow epicondylitis; platelet-rich plasma; autologous whole blood; pain; function

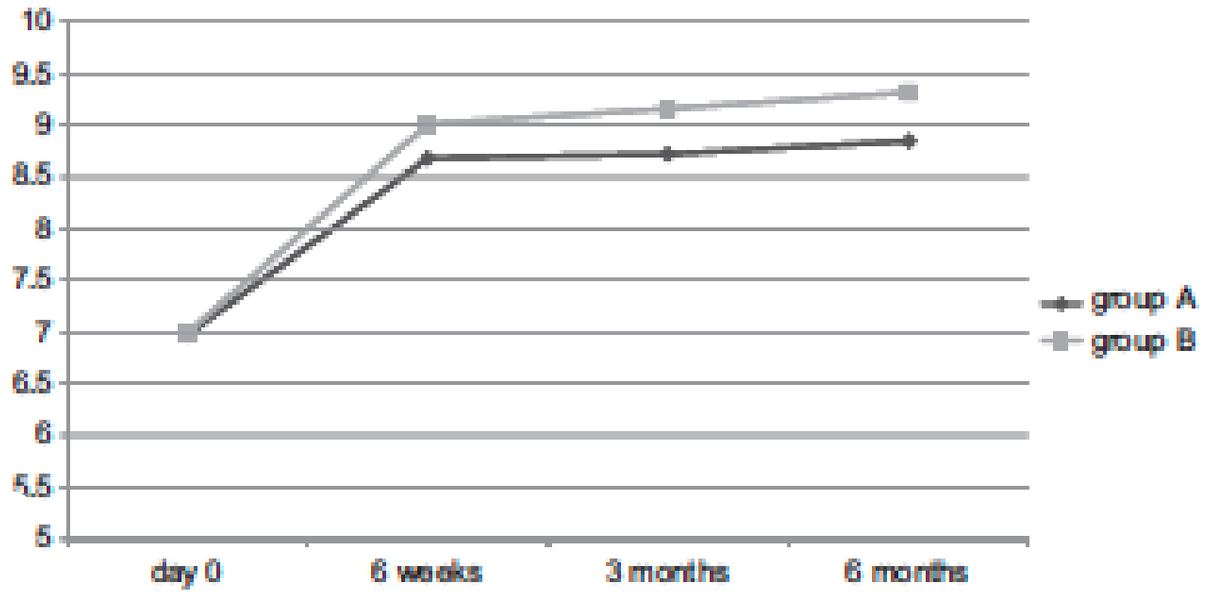


group	day 0	6 weeks*	3 months	6 months
A	6.0 (5.32-6.68)	3.5 (2.82-4.18)	2.78 (2.28-3.28)	2.53 (1.89-3.17)
B	6.1 (5.43-6.77)	2.35 (1.83-2.87)	1.92 (1.41-2.43)	1.78 (1.14-2.42)

Figure 1. Pain visual analog scale score distribution (95% confidence interval). 0, no pain; 10, max pain. *Indicates significant difference between groups.

PRP vs sang autologue =

→ Qualité du PRP !



group	day 0	6 weeks	3 months	6 months
A	6.97 (6.65-7.29)	8.68 (8.49-8.08)	8.72 (8.35-9.09)	8.85 (8.40-9.30)
B	6 99 6 98 7 30)	9.01 (8.59-9.43)	9.16 (8.73-9.59)	9.32 (9.05-9.59)

Figure 2. Liverpool elbow score regarding time (95% confidence interval). 0, worst score; 10, best score. No significant difference.

Étude comparative de cinq techniques de préparation plaquettaire (*platelet-rich plasma*)

Comparative study of five techniques of preparation of platelet-rich plasma

J.-F. Kaux [a,*], C. Le Goff [b], L. Seidel [c], P. Péters [b], A. Gothot [b], A. Albert [c], J.-M. Crielaard [a]

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[b] *Département de biologie clinique, université de Liège, CHU Sart-Tilman, avenue de l'Hôpital, B35, Liège, Belgique*
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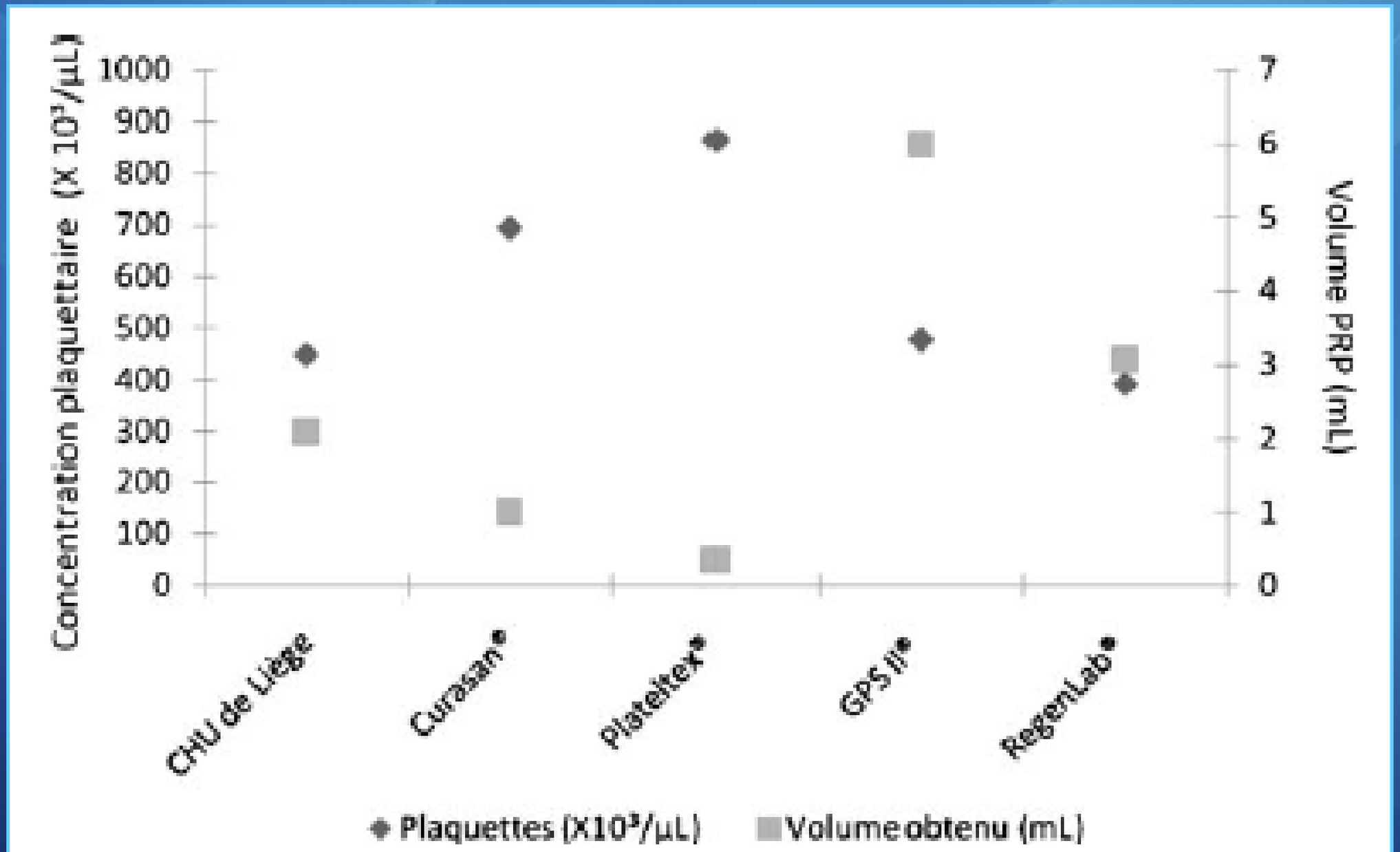
Disponible sur Internet le 28 mai 2009

Résumé

But de l'étude. – L'injection de concentrés plaquettaires (plasma riche en plaquettes ou PRP) fait actuellement l'objet de recherche dans le cadre de thérapeutique des tendinopathies chroniques. L'injection intratendineuse nécessite idéalement un volume minimal afin de diminuer la pression lors de l'injection et minimiser les douleurs, mais il doit également présenter une concentration plaquettaire élevée ; par ailleurs, la quantité de facteurs de croissance libérés pourrait être liée au système de préparation. Nous avons donc comparé cinq techniques de concentration de plaquettes.
Matériels et méthodes. – Divers échantillons de sang veineux ont été prélevés chez cinq patients afin de comparer les cinq techniques de préparation du PRP, respectivement celle du CHU de Liège, le PRP Kit de Curasan®, les techniques Plateltex®, GPS®II et RegenLab®.
Résultats. – Les différentes techniques permettent d'obtenir des concentrations plaquettaires plus importantes que dans le sang avec des volumes variables (de 0,3 à 6 ml) et un nombre limité de globules rouges et globules blancs (sauf pour GPS®II). Le nombre de plaquettes par microlitre apparaît plus élevé avec la technique Plateltex® et obtient le plus petit volume à injecter. Les autres techniques permettent également d'obtenir de petits volumes sauf avec le GPS®II. Le nombre de plaquettes collectées dans le volume PRP apparaît donc plus élevé avec cette technique. La meilleure efficience de récolte plaquettaire est obtenue avec la technique RegenLab®.
Conclusion. – La technique Plateltex® permet le recueil de la concentration plaquettaire la plus élevée dans le volume le plus faible.

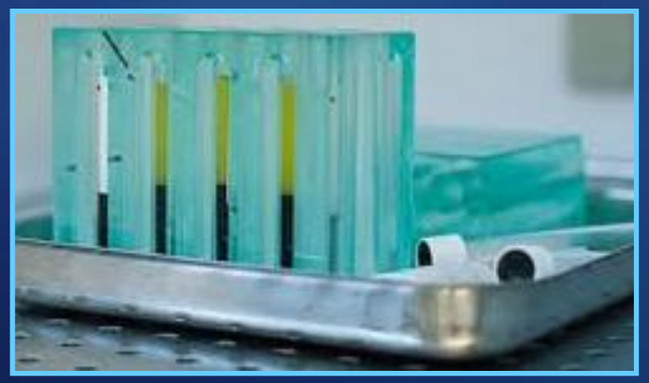
Mots clés : Plasma riche en plaquettes ; PRP ; Concentration plaquettaire


Concentration plaquettaire (X 10³/µL)
1000
900
800
700
600
500
400
300
200
100
0
Volume PRP (mL)
7
6
5
4
3
2
1
0
CHU de Liège
Curasan®
Plateltex®
GPS II®
RegenLab®
Plaquettes (X10³/µL)
Volume obtenu (mL)


PATHOLOGIE
BIOLOGIE

PRP

- ***Différentes*** techniques → ***différents*** PRP
  - variabilité ***concentration*** plaquettaire
  - présence ou non de ***GR*** et ***GB***



Platelet-rich plasma intra-articular injections for cartilage degeneration and osteoarthritis: single- versus double-spinning approach

Giuseppe Filardo · Elizaveta Kon · Maria Teresa Pereira Ruiz · Franca Vaccaro · Rita Guitaldi · Alessandro Di Martino · Annarita Cenacchi · Pier Maria Fornasari · Maurilio Marcacci

Abstract

Purpose To compare the safety and efficacy of two different approaches of platelet-rich plasma (PRP) production methods as intra-articular injection treatment for knee cartilage degenerative lesions and osteoarthritis (OA).

Methods The study involved 144 symptomatic patients affected by cartilage degenerative lesions and OA. Seventy-two patients were treated with 3 injections of platelet concentrate prepared with a single-spinning procedure (PRGF), the other 72 with 3 injections of PRP obtained with a double-spinning approach. The patients were evaluated prospectively at the enrollment and at 2, 6, and 12 months' follow-up with IKDC, EQ-VAS and Tegner scores; adverse events and patient satisfaction were also recorded.

Results Both treatment groups presented a statistically significant improvement in all the scores evaluated at all the follow-up times. Better results were achieved in both groups in younger patients with a lower degree of cartilage degeneration. The comparative analysis showed similar improvements with the two procedures: in particular, IKDC subjective evaluation increased from 45.0 ± 10.1 to 59.0 ± 16.2, 61.3 ± 16.3, and 61.6 ± 16.2 at 2, 6, and 12 months in the PRGF group, and from 42.1 ± 13.5 to 60.8 ± 16.6, 62.5 ± 19.9, and 59.9 ± 20.0 at 2, 6, and 12 months in the PRP group, respectively. Concerning adverse events, more swelling ($P = 0.03$) and pain reaction ($P = 0.0005$), were found after PRP injections.

Conclusions Although PRP injections produced more pain and swelling reaction with respect to that produced by PRGF, similar results were found at the follow-up times, with a significant clinical improvement with respect to the basal level. Better results were achieved in younger patients with a low degree of cartilage degeneration.

Level of evidence II.

Keywords PRP · Cartilage · Osteoarthritis · Knee · Intra-articular injection

LETTER TO THE EDITOR

The type of platelet-rich plasma may influence the safety of the approach

Eduardo Anitua · Mikel Sánchez · Roberto Prado · Gorka Orive

Comparison of the Acute Inflammatory Response of Two Commercial Platelet-Rich Plasma Systems in Healthy Rabbit Tendons

Jason L. Dragoo,*† MD, Hillary J. Braun,† BA, Jennah L. Durham,† BA, Bethany A. Ridley,† BA, Justin I. Odegaard,‡ MD, Richard Luong,§ BVSc, DACVP, and Steven P. Arnoczky,‖ DVM
Investigation performed at Stanford University, Palo Alto, California

Background: Numerous studies have shown platelet-rich plasma (PRP) preparations differ with respect to the inclusion of certain blood components, which may affect the host's cellular response.

Hypothesis: This study evaluated the inflammatory effect of Biomet GPS III leukocyte-rich PRP (LR-PRP) versus MTF Cascade leukocyte-poor PRP (LP-PRP) after intratendinous injection in an animal model. The authors anticipated that LR-PRP would incite a greater acute inflammatory response than LP-PRP.

Study Design: Controlled laboratory study.

Methods: A total of 17 skeletally mature New Zealand White rabbits were tested. In all cases, healthy patellar tendons were treated. In the control animals, one patellar tendon was injected with 2 mL autologous whole blood, and the other was injected with 2 mL sterile saline. Seven total tendons were injected with whole blood, and 7 tendons were injected with saline. In the experimental animals, one patellar tendon was injected with 2 mL LR-PRP, and the other was injected with 2 mL LP-PRP. Ten tendons were injected with LR-PRP, and 10 tendons were injected with LP-PRP. Animals were euthanized at 5 or 14 days after injection. Tendons were harvested and stained using hematoxylin and eosin and scored semi-quantitatively for total white blood cells (WBCs), mononuclear cells (macrophages and lymphocytes), polymorphonuclear cells (PMNs), vascularity, fiber structure, and fibrosis.

Results: At 5 days after injection, tendons treated with LR-PRP had significantly greater overall tendon scores (6.3 ± 1.79 vs 1.8 ± 1.64, $P = .012$), as well as mean scores for fiber structure (1.4 ± 0.22 vs 0.50 ± 0.50, $P = .012$), denoting disrupted composition, total WBCs (1.1 ± 0.89 vs 0.10 ± 0.22, $P = .014$), mononuclear cells (macrophages and lymphocytes) (0.80 ± 0.45 vs 0.10 ± 0.22, $P = .014$), vascularity (1.7 ± 0.27 vs 0.80 ± 0.16, $P = .008$), and fibrosis (1.0 ± 0.35 vs 0.3 ± 0.45, $P = .037$) compared with tendons treated with LP-PRP. Otherwise, there were no significant differences in mononuclear cells ($P = .590$), PMN cells ($P = 1.00$), total WBCs ($P = .811$), vascularity ($P = .650$), or total tendon score ($P = .596$) in any of the treatment groups at 14 days.

Conclusion: Compared with leukocyte-poor Cascade PRP, leukocyte-rich GPS III PRP causes a significantly greater acute inflammatory response at 5 days after injection. There is no significant difference in the inflammatory response or cellularity regardless of the injection type at 14 days after intratendinous injection.

Clinical Relevance: Platelet-rich plasma injections are frequently prepared using commercial systems and are administered for clinical treatment of chronic tendinopathy. It is important to characterize the cellular responses elucidated by different injection preparations to further understand their effect on tissue healing and aid clinical decision making. Future investigations are necessary to apply these findings to the clinical setting.

Keywords: platelet-rich plasma; inflammation; tendinopathy; injection; leukocytes; rabbits

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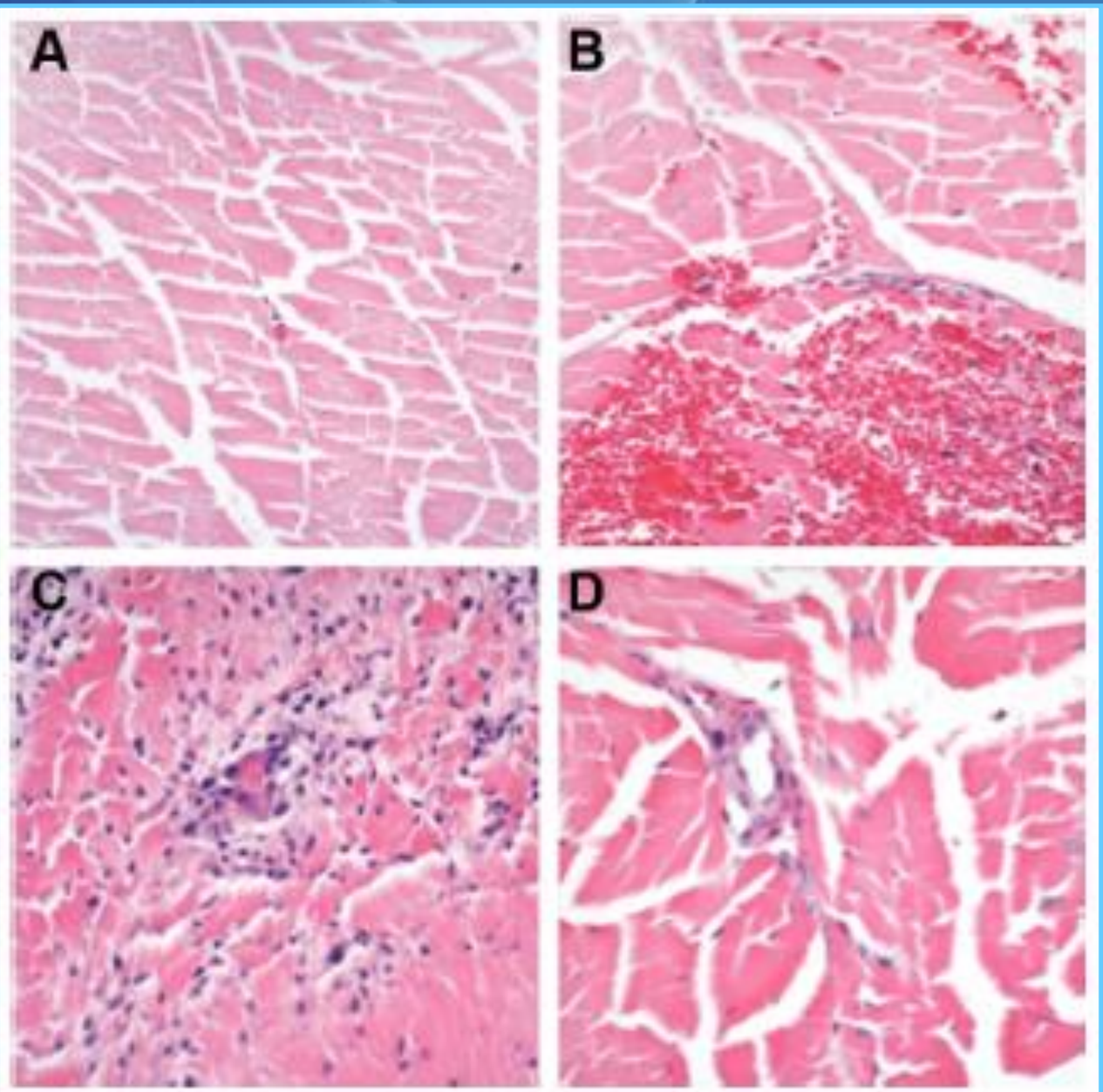

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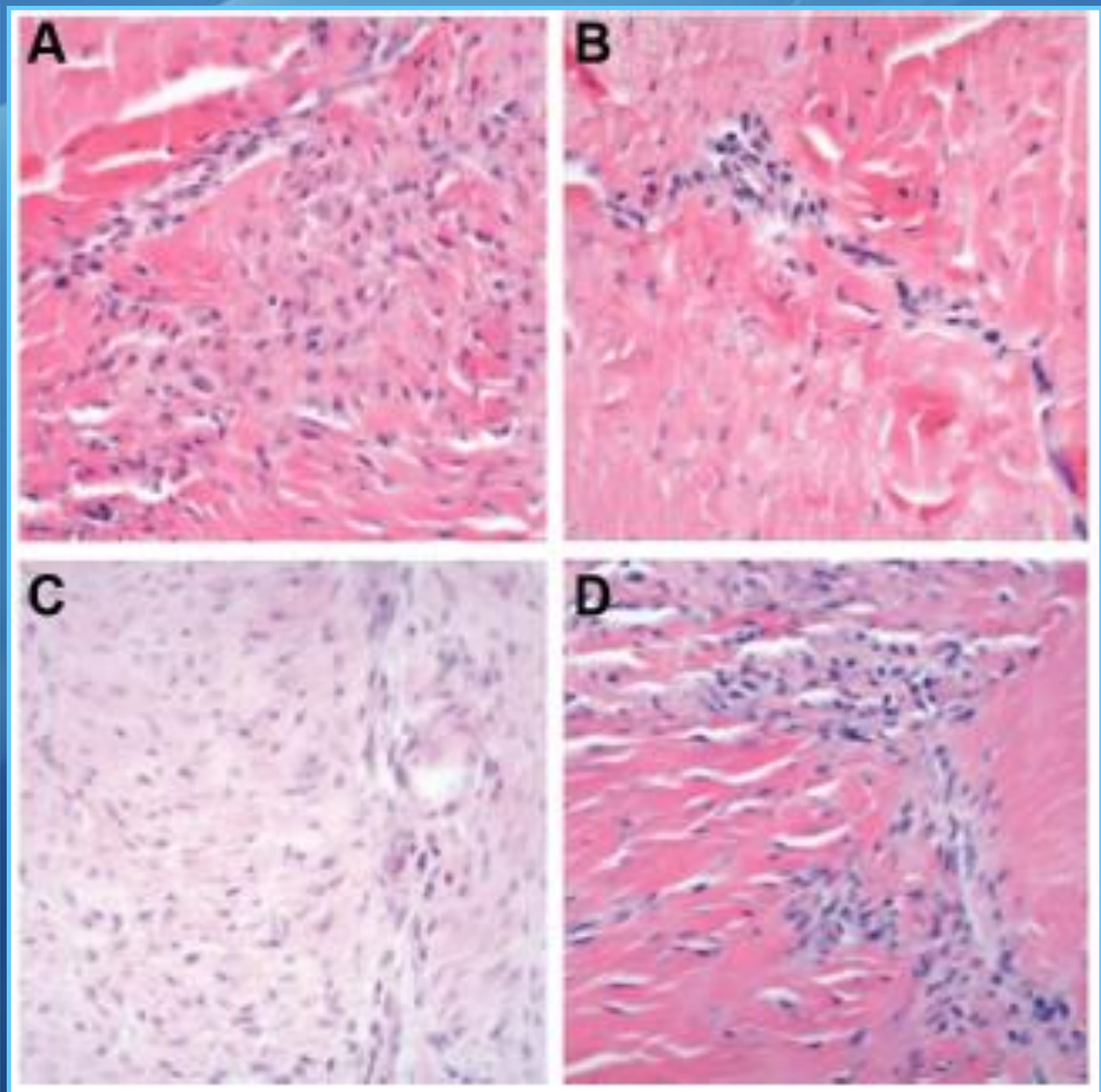
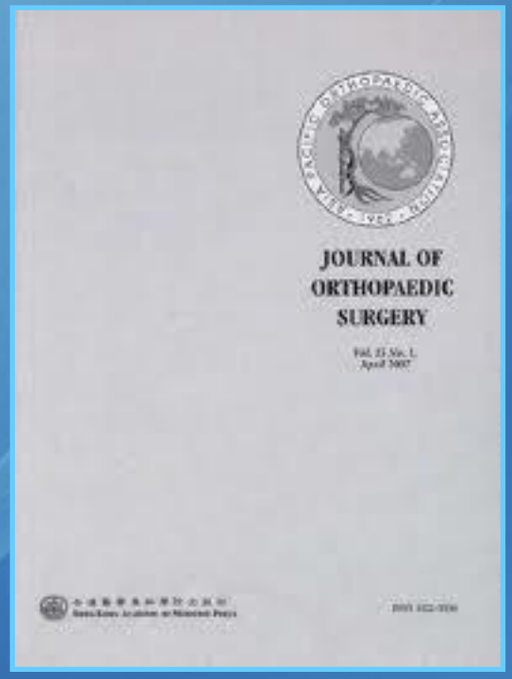


Tendinopathies coiffe des rotateurs

Platelet-rich plasma for calcific tendinitis of the shoulder: a case report

Roberto Seijas, Oscar Ares, Pedro Alvarez, Xavier Cusco, Montserrat Garcia-Balletbo, Ramon Cugat
Fundacion Garcia Cugat, Hospital Quiron, Barcelona, Spain



ABSTRACT

We report a 44-year-old woman with calcific tendinitis of the shoulder treated with platelet-rich plasma injection. Prior to this, she had no improvement of the symptoms after 6 weeks of ultrasound treatment, Codman exercises, and anti-inflammatory treatment. Platelet-rich plasma was injected into the subacromial area 3 times at 2-week intervals. She had progressive improvement of pain after 2 weeks, and was asymptomatic at week 6. The patient then underwent the previous protocol of rehabilitation. At the one-year follow-up, the patient was pain-free and had complete resolution of calcific tendinitis. The patient had regained full range of movement and had resumed all her activities.

Key words: *platelet-rich plasma; tendinopathy*

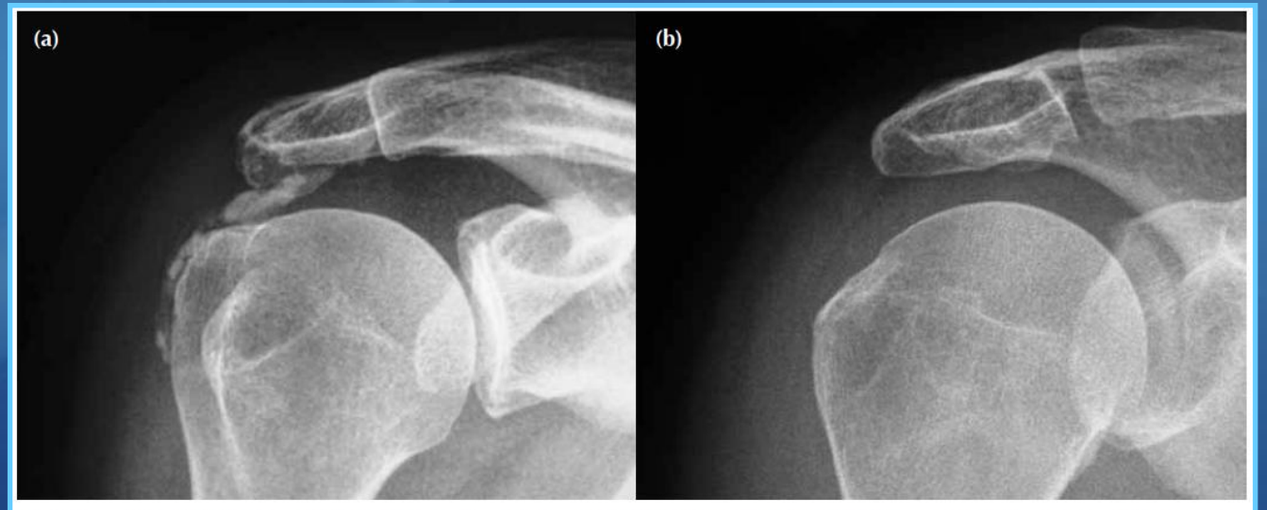


Figure **(a)** Calcification and **(b)** complete resolution of the cronical aspect of the distal portion of the rotatory cuff in the area of insertion of the supraspinatus.

Platelet rich plasma in arthroscopic rotator cuff repair: a prospective RCT study, 2-year follow-up

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Autologous platelet rich plasma for arthroscopic rotator cuff repair. A

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Dipartimento di Scienze Medico-Chirurgiche, Policlinico San Donato, Universita degli Studi di Milano, Milano, Italy.

The "Cascade" membrane: a new PRP device for tendon ruptures. Description and case report on rotator cuff tendon

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Abstract. Rotator cuff tears are common soft-tissue injuries that often require surgical treatment. Initial efforts to better tendon healing centered on improving the strength of repair. More recent studies have focused on abiologic enhancement of the healing process. Platelet rich plasma (PRP) is a fraction of plasma that has been isolated and used to enhance regeneration in bone and soft tissues. The healing potential of PRP has been attributed to the release of multiple growth factors from the highly concentrated platelets. The "Cascade" membrane is a thin layer of autologous fibrine that is very rich in platelets and is obtained by high speed centrifugation of a small quantity of PRP. The Authors present the case of C.U., a right-handed 53year-old male that came to our attention complaining of severe right shoulder pain and ROM reduction. The MRI showed a thick tear of the sovraspinatus tendon with retraction of the muscle. The patient underwent surgical repair with arthroscopy and mini-open approach with acromionplasty, subacromial decompression, cuff repair by trans-bone suture and application of the "Cascade" membrane (A.T. Grade Milano, Italy) that was sutured side-to-side to close the 10 mm tear. A standard rehabilitation protocol for rotator cuff tears was performed. A MRI 6 months after surgical repair showed the complete integrity of the cuff under the membrane. Currently no widely accepted treatment for massive, irreparable rotator cuff tears is available. Allograft reconstruction to span the remaining defect in massive rotator cuff tears will lead to increase functional results; we believe that further studies are needed to describe and evaluate its potential in tendon healing; multiple MRI studies will demonstrate healing of the tendon with the graft. (www.actabiomedica.it)

Key words: Tendon healing, rotator cuff tear, growth factors

Platelet-Rich Plasma Augmentation for Arthroscopic Rotator Cuff Repair

A Randomized Controlled Trial

Roberto Castricini,* MD, Umile Giuseppe Longo,† MD, MSc, Massimo De Benedetto,‡ MD, Nicola Panfoli,* MD, Piergiorgio Pirani,‡ MD, Raul Zini,‡ MD, Nicola Maffulli,§‖ MD, MS, PhD, FRCS(Orth), and Vincenzo Denaro,† MD
Investigation performed at the Department of Orthopaedic and Trauma Surgery, Ospedale Civile, Jesi, Italy

Background: After reinsertion on the humerus, the rotator cuff has limited ability to heal. Growth factor augmentation has been proposed to enhance healing in such procedure.

Purpose: This study was conducted to assess the efficacy and safety of growth factor augmentation during rotator cuff repair.

Study Design: Randomized controlled trial; Level of evidence, 1.

Methods: Eighty-eight patients with a rotator cuff tear were randomly assigned by a computer-generated sequence to receive arthroscopic rotator cuff repair without (n = 45) or with (n = 43) augmentation with autologous platelet-rich fibrin matrix (PRFM). The primary end point was the postoperative difference in the Constant score between the 2 groups. The secondary end point was the integrity of the repaired rotator cuff, as evaluated by magnetic resonance imaging. Analysis was on an intention-to-treat basis.

The Effect of Platelet-Rich Fibrin Matrix on Rotator Cuff Tendon Healing

A Prospective, Randomized Clinical Study

Scott A. Rodeo,*† MD, Demetris Delos,† MD, Riley J. Williams,† MD, Ronald S. Adler,† MD, PhD, Andrew Pearle,† MD, and Russell F. Warren,† MD
Investigation performed at Sports Medicine and Shoulder Service, The Hospital for Special Surgery, New York, New York

Background: There is a strong need for methods to improve the biological potential of rotator cuff tendon healing. Platelet-rich fibrin matrix (PRFM) allows delivery of autologous cytokines to healing tissue, and limited evidence suggests a positive effect of platelet-rich plasma on tendon biology.

Purpose: To evaluate the effect of platelet-rich fibrin matrix on rotator cuff tendon healing.

Study Design: Randomized controlled trial; Level of evidence, 2.

Methods: Seventy-nine patients undergoing arthroscopic rotator cuff tendon repair were randomized intraoperatively to either receive PRFM at the tendon-bone interface (n = 40) or standard repair with no PRFM (n = 39). Standardized repair techniques were used for all patients. The postoperative rehabilitation protocol was the same in both groups. The primary outcome was tendon healing evaluated by ultrasound (intact vs defect at repair site) at 6 and 12 weeks. Power Doppler ultrasound was also used to evaluate vascularity in the peribursal, peritendinous, and musculotendinous and insertion site areas of the tendon and bone anchor site. Secondary outcomes included standardized shoulder outcome scales (American Shoulder and Elbow Surgeons [ASES] and L'Insalata) and strength measurements using a handheld dynamometer. Patients and the evaluator were blinded to treatment group. All patients were evaluated at minimum 1-year follow-up. A logistic regression model was used to predict outcome (healed vs defect) based on tear severity, repair type, treatment type (PRFM or control), and platelet count.

Results: Overall, there were no differences in tendon-to-bone healing between the PRFM and control groups. Complete tendon-to-bone healing (intact repair) was found in 24 of 36 (67%) in the PRFM group and 25 of 31 (81%) in the control group ($P = .20$). There were no significant differences in healing by ultrasound between 6 and 12 weeks. There were gradual increases in ASES and L'Insalata scores over time in both groups, but there were no differences in scores between the groups. We also found no difference in vascularity in the peribursal, peritendinous, and musculotendinous areas of the tendon between groups. There were no differences in strength between groups. Platelet count had no effect on healing. Logistic regression analysis demonstrated that PRFM was a significant predictor ($P = .037$) for a tendon defect at 12 weeks, with an odds ratio of 5.8.

Conclusion: Platelet-rich fibrin matrix applied to the tendon-bone interface at the time of rotator cuff repair had no demonstrable effect on tendon healing, tendon vascularity, manual muscle strength, or clinical rating scales. In fact, the regression analysis suggests that PRFM may have a negative effect on healing. Further study is required to evaluate the role of PRFM in rotator cuff repair.

Keywords: platelet-rich plasma; platelet-rich fibrin matrix; rotator cuff

Tendinopathies rotuliennes

Treatment of chronic patellar tendinosis with buffered platelet rich plasma: a preliminary study

Trattamento delle tendinopatie croniche del tendine rotuleo con fattori di crescita (plasma ricco di piastrine): studio preliminare

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[2] Department of Medical Pharmacology, Faculty of Medicine, University of Milan, Galeazzi Orthopaedics Institute, IRCCS, Milan, Italy
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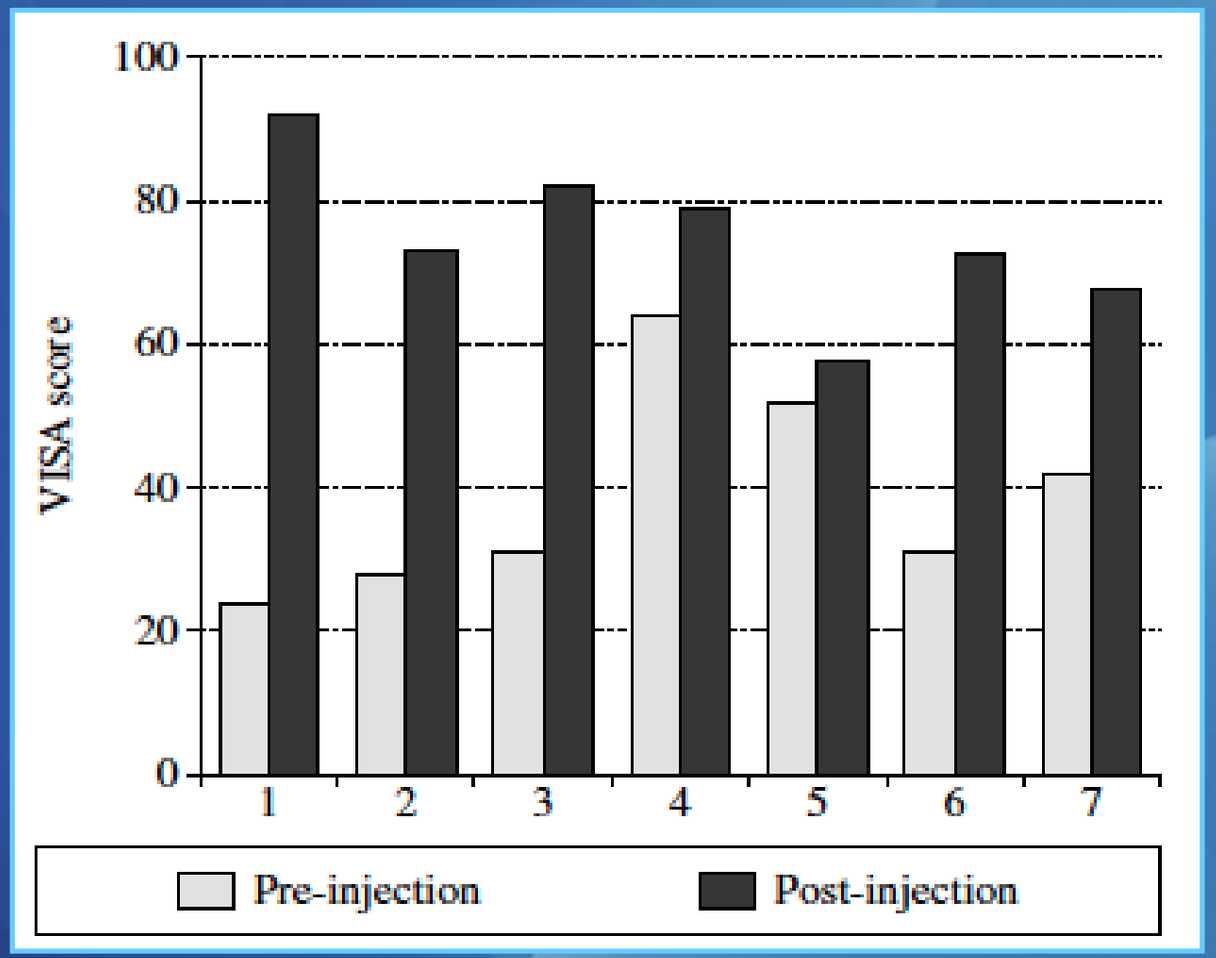
SUMMARY

Eight athletes considering surgical intervention for chronic patellar tendinosis that was recalcitrant to conservative physical therapy and a variety of non-operative treatments were recruited into the study. Following pre-injection MRI imaging and VISA score assessment, patients received a single injection of PRP (Platelet-Rich Plasma). Patients were given individualized rehabilitation protocols and followed until a final assessment at 120 days post-injection.

Seven of the eight patients were assessed at the final follow-up, with all of them demonstrating an improvement on the VISA score. One patient elected to have surgical intervention prior to the final follow-up and was not included in the analysis. The average VISA score at the final assessment was 75.0 compared to a pre-injection average of 39.25. This represented a 91% of average improvement in the VISA score ($p<0.001$). MRI images at the final follow-up demonstrated a noticeable reduction in irregularity of the affected tendon compared to pre-injection images for 80% of the treated tendons.

Treatment of chronic patellar tendinosis in a series of athletes resulted in a statistically significant improvement in VISA score for seven of the eight patients treated. Pre and post-injection MRI demonstrated reduced irregularity in eighty percent of the injected tendons. Further evaluation of this treatment is warranted.

KEY WORDS: Platelet-rich plasma - Patellar tendon - Tendinosis - Tendonitis.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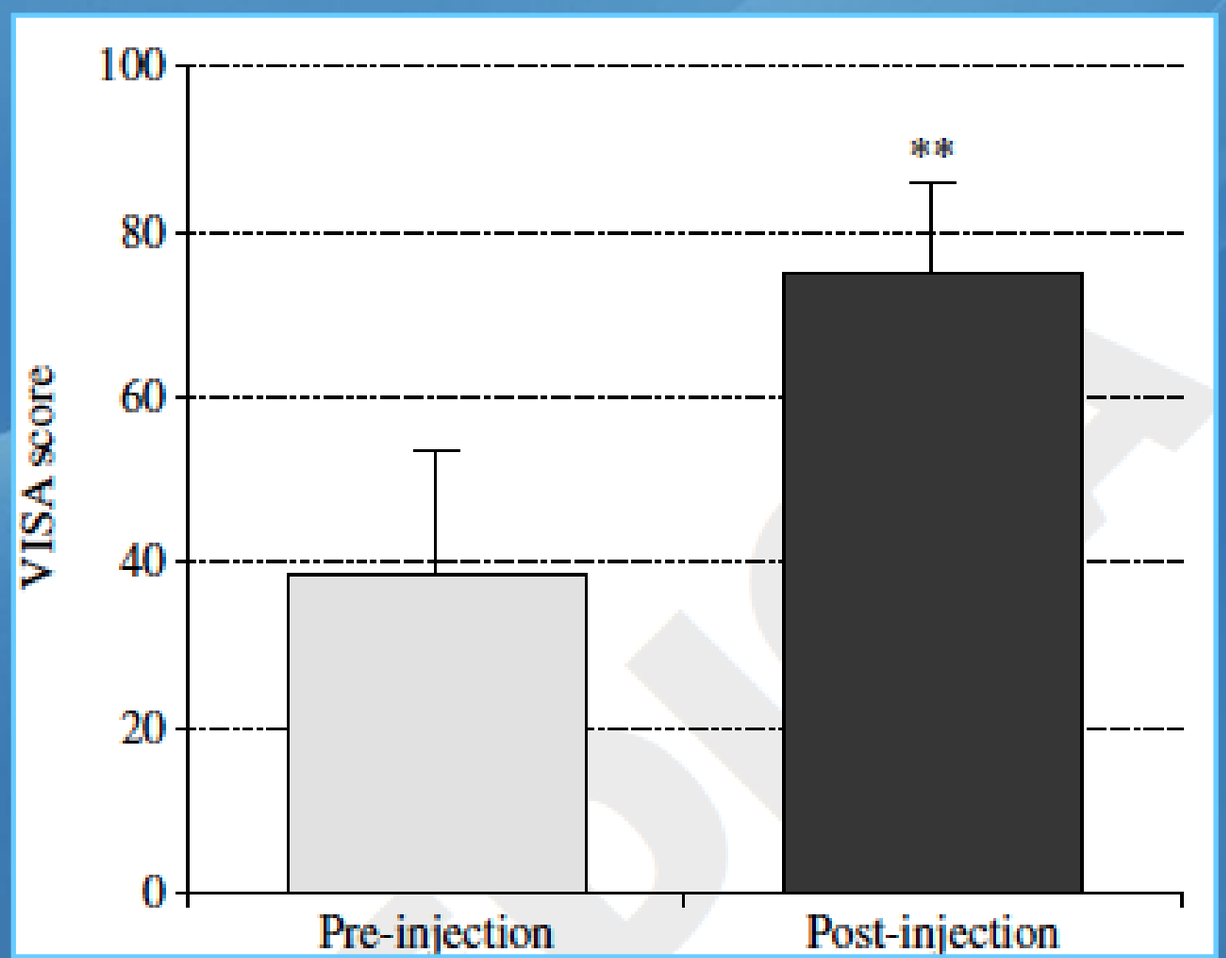
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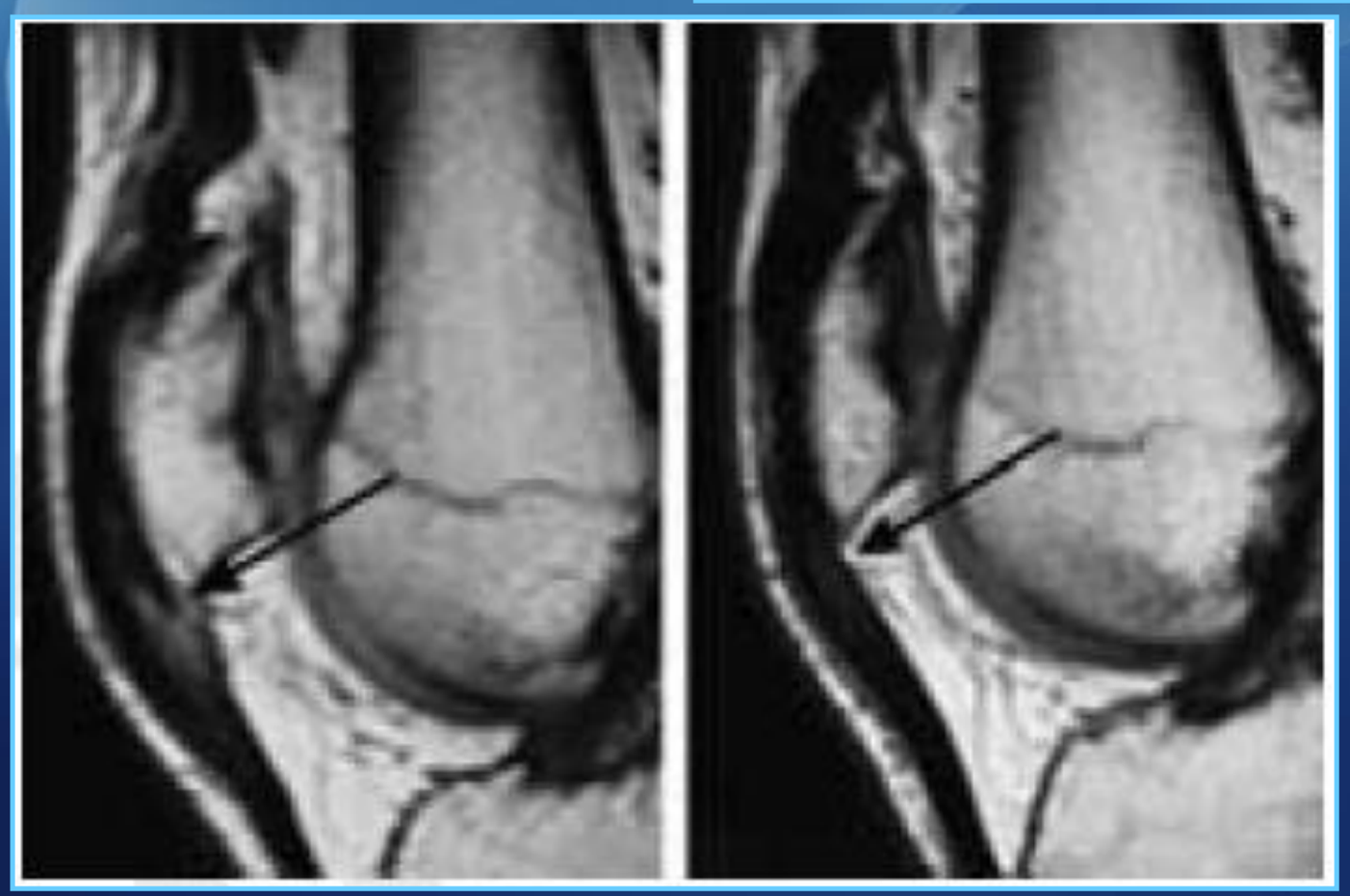

Platelet-rich plasma: New clinical application
A pilot study for treatment of jumper's knee

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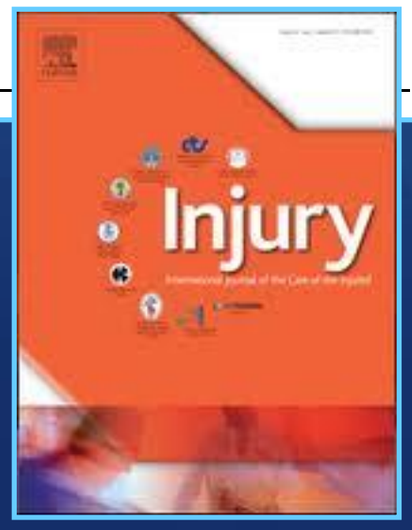
Jumper's knee
Patellar tendinosis

ABSTRACT

This study describes a simple, low-cost, minimally invasive way to apply PRP growth factors to chronic patellar tendinosis; 20 male athletes with a mean history of 20.7 months of pain received treatment, and outcomes were prospectively evaluated at 6 months follow-up. No severe adverse events were observed, and statistically significant improvements in all scores were recorded. The results suggest that this method may be safely used for the treatment of jumper's knee, by aiding the regeneration of tissue which otherwise has low healing potential.



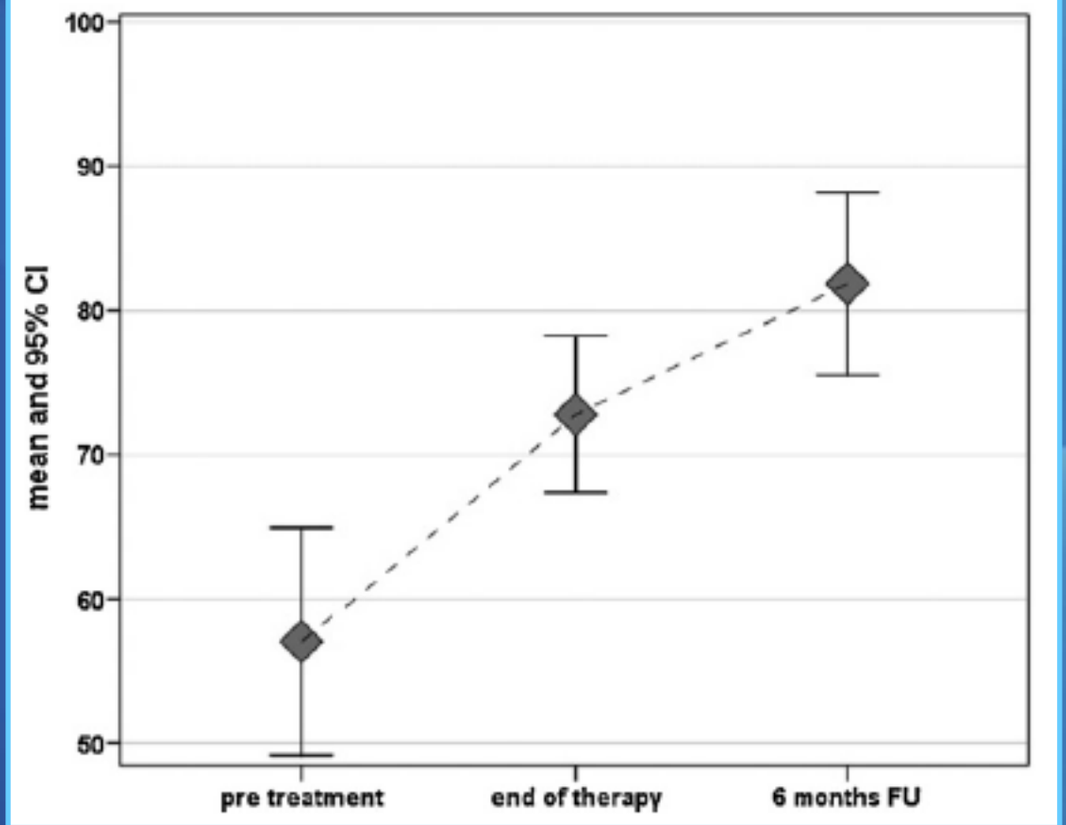


Fig. 4. Health status evaluated with EQ-VAS (means and CIs). CI, confidence interval; FU, follow-up.

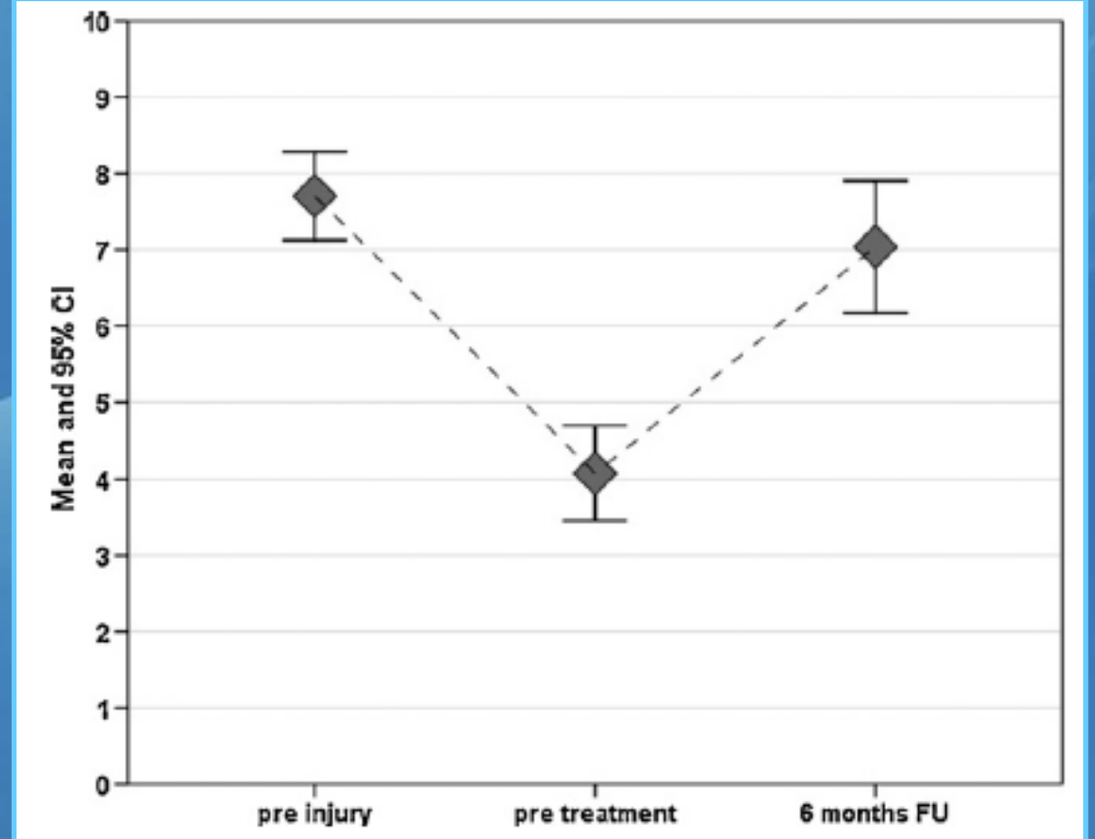


Fig. 5. Sport activity level evaluated with the Tegner score (means and CIs). CI, confidence interval; FU, follow-up.

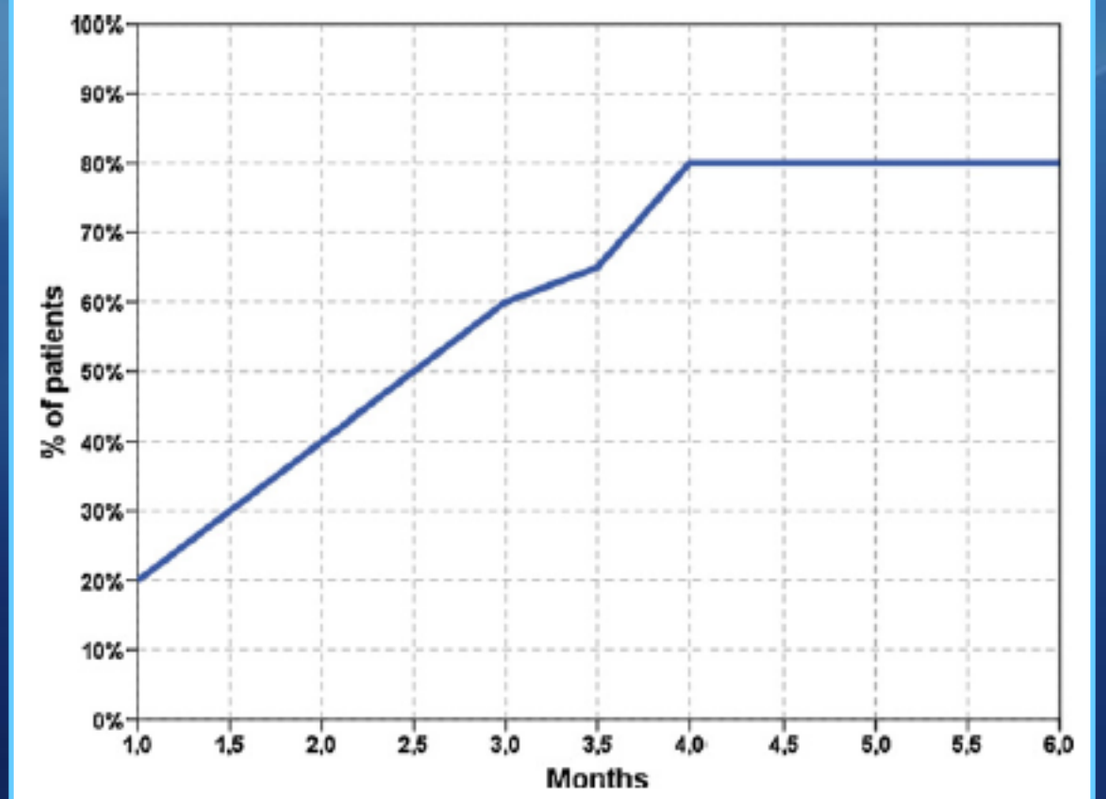
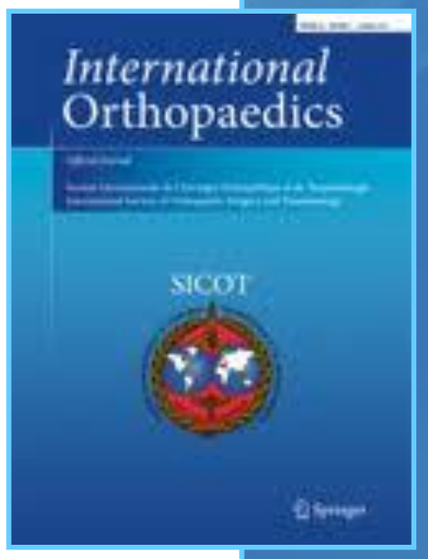


Fig. 6. Percentage of participants resuming sports after treatment, at different follow-up points.

Use of platelet-rich plasma for the treatment of refractory jumper's knee



Giuseppe Filardo · Elizaveta Kon · Stefano Della Villa · Ferruccio Vincentelli · Pier Maria Fornasari · Maurilio Marcacci

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Abstract The aim of this study was to evaluate the efficacy of multiple platelet-rich plasma (PRP) injections on the healing of chronic refractory patellar tendinopathy after previous classical treatments have failed. We treated 15 patients affected by chronic jumper's knee, who had failed previous nonsurgical or surgical treatments, with multiple PRP injections and physiotherapy. We also compared the clinical outcome with a homogeneous group of 16 patients primarily treated exclusively with the physiotherapy approach. Multiple PRP injections were performed on three occasions two weeks apart into the site of patellar tendinopathy. Tegner, EQ VAS and pain level were used for clinical evaluation before, at the end of the treatment and at six months follow-up. Complications, functional recovery and patient satisfaction were also recorded. A statistically significant improvement in all scores was observed at the end of the PRP injections in patients with chronic refractory patellar tendinopathy and a further improvement was noted at six months, after physiotherapy was added. Moreover, comparable results were obtained with respect to the less severe cases in the EQ VAS score and pain level evaluation, as in time to recover and patient satisfaction, with an even higher improvement in the sport activity level achieved in the PRP group. The clinical results are encouraging, indicating that PRP injections have the potential to promote the achievement of a satisfactory clinical outcome, even in difficult cases with chronic refractory tendinopathy after previous classical treatments have failed.

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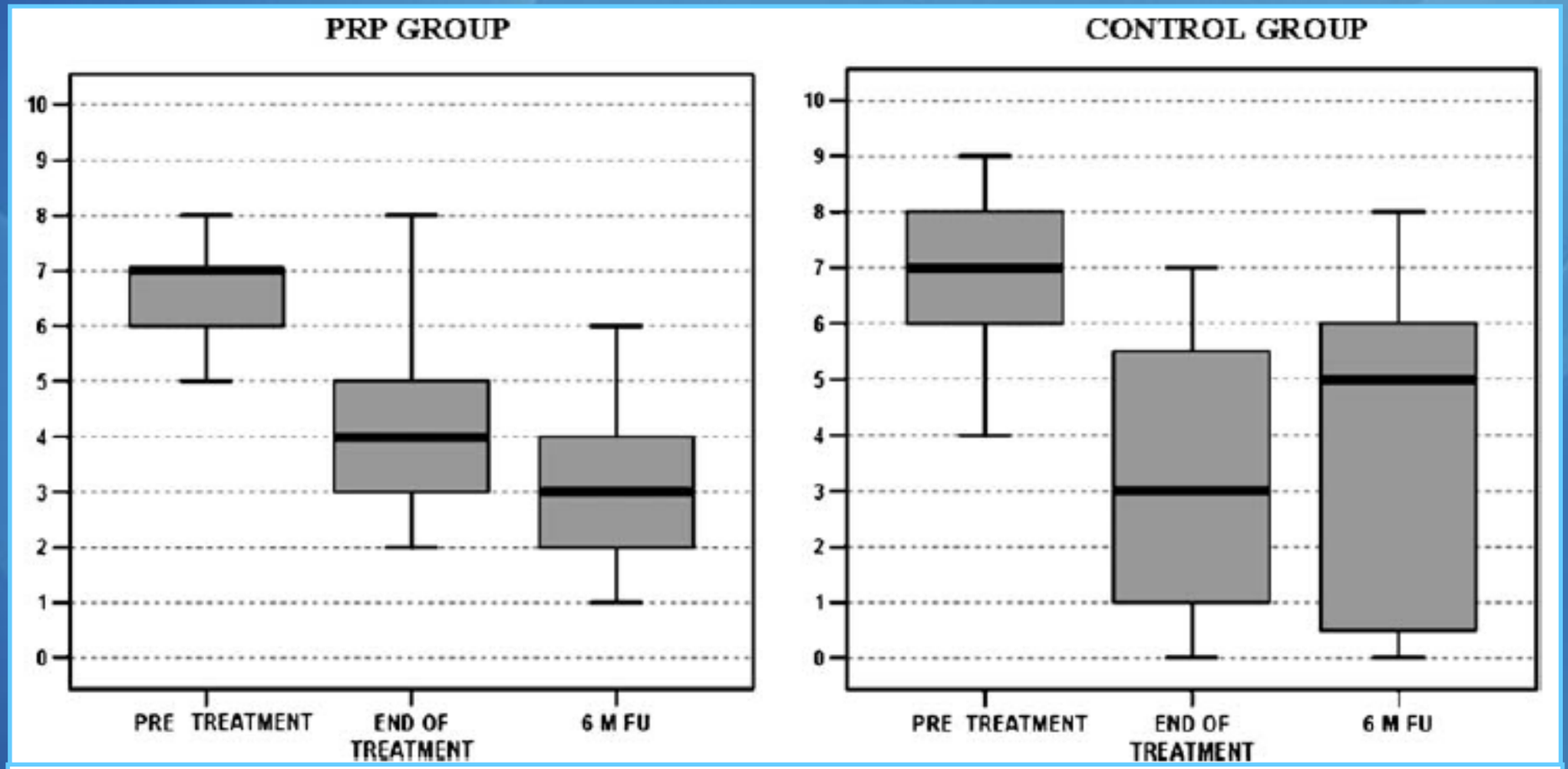
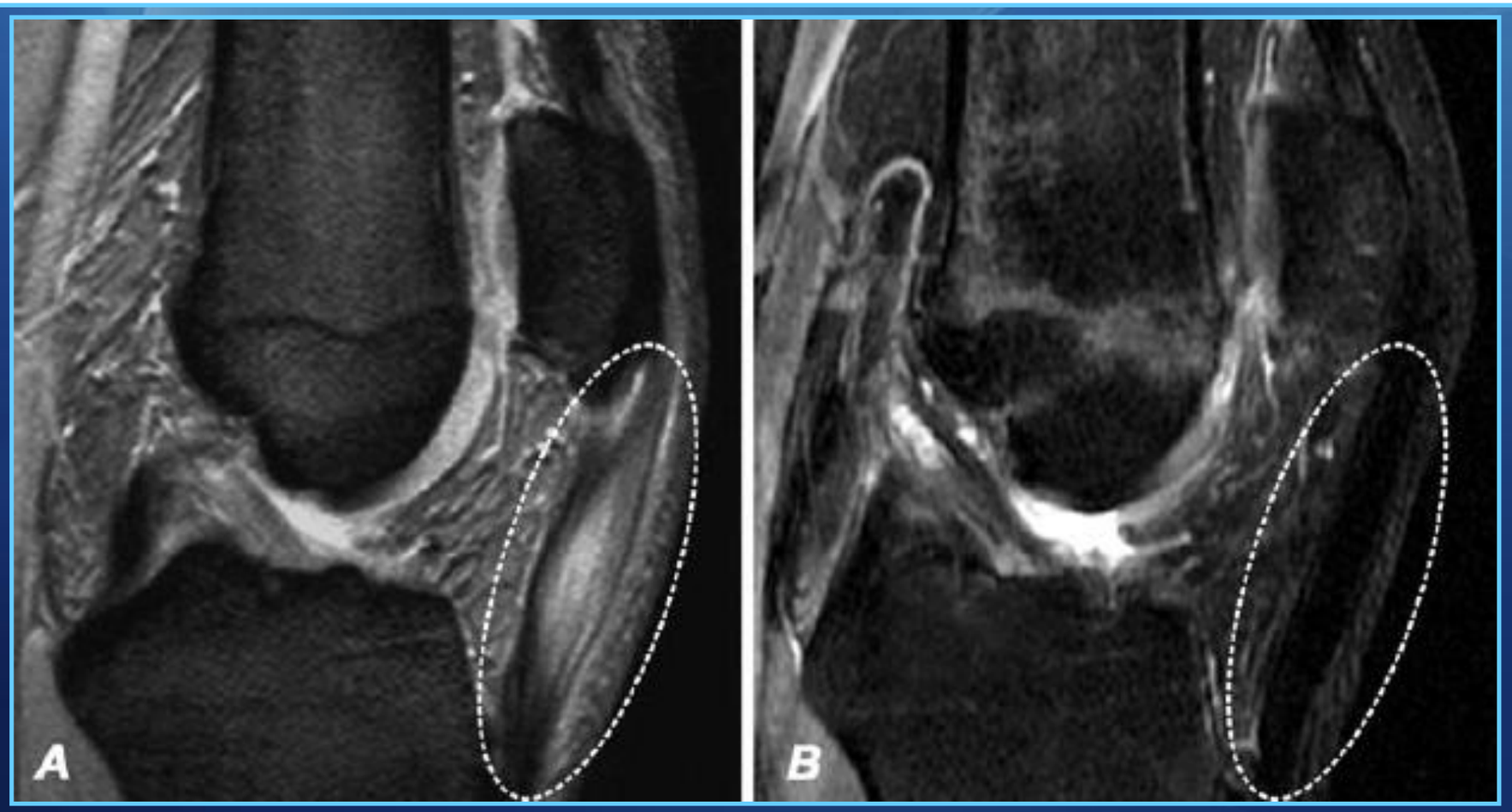
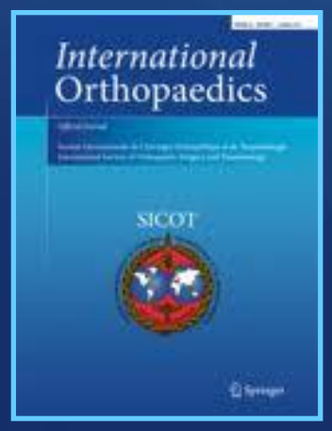


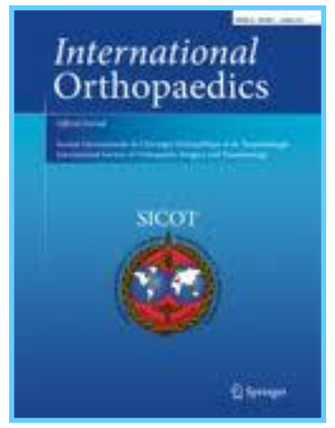
Fig. 2 Comparison of the pain level, evaluated on a 1–10 scale, in the platelet-rich plasma (PRP) and control groups





Pain and activity levels before and after platelet-rich plasma injection treatment of patellar tendinopathy: a prospective cohort study and the influence of previous treatments

Taco Gosens · Brenda L. Den Oudsten · Erik Fievez · Paula van 't Spijker · Alex Fievez



Received: 19 January 2012 / Accepted: 27 March 2012 / Published online: 27 April 2012

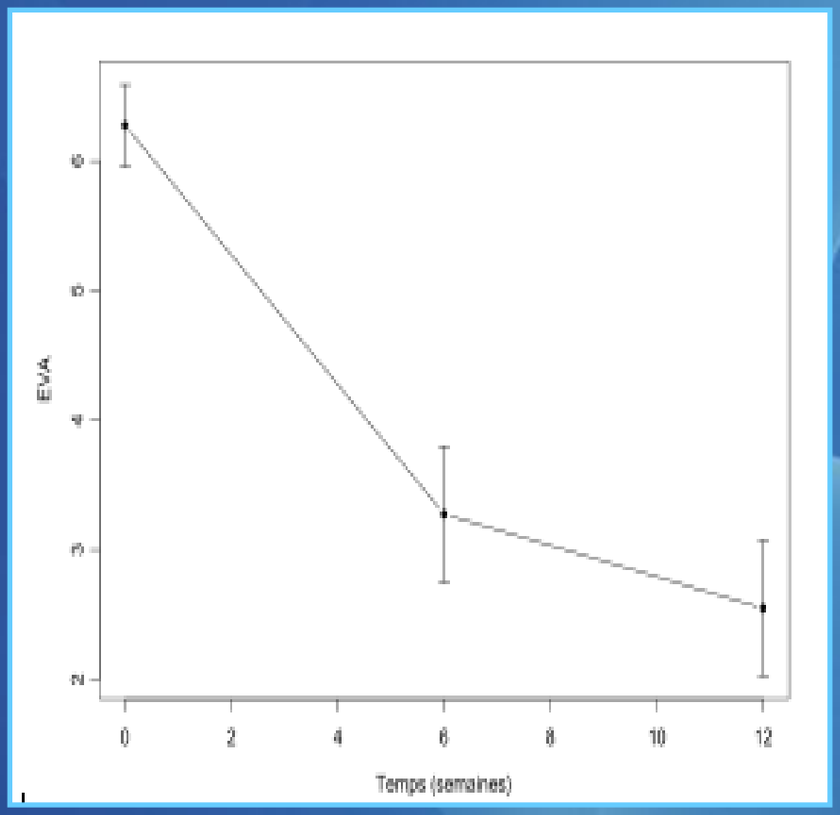
Abstract

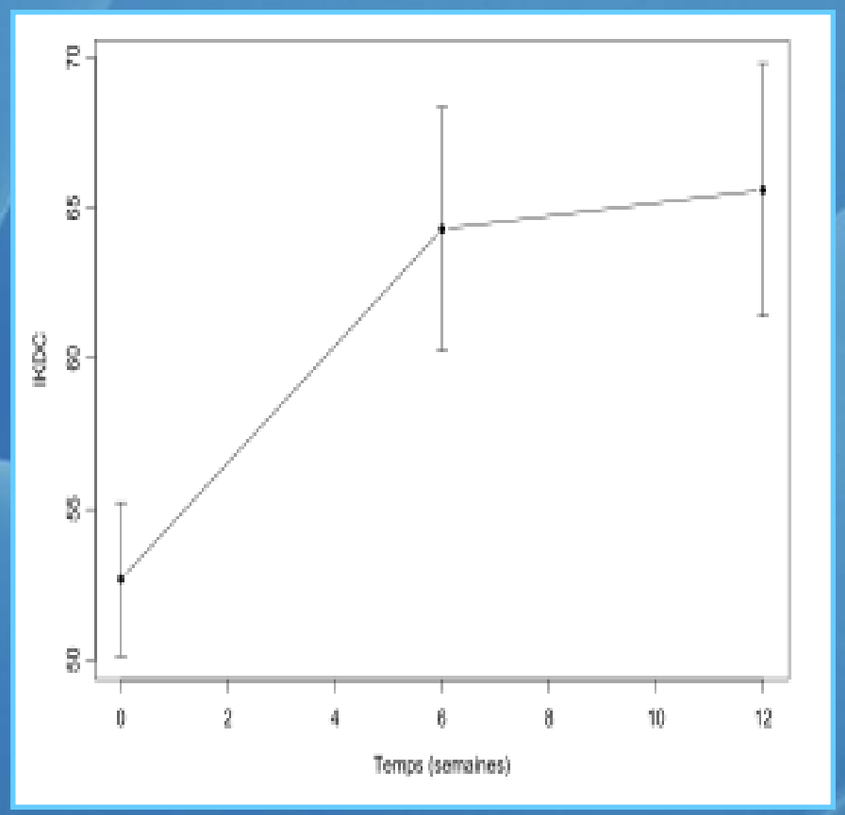
Purpose The aim of this study was to evaluate the outcome of patients with patellar tendinopathy treated with platelet-rich plasma injections (PRP). Additionally, this study examined whether certain characteristics, such as activity level or previous treatment affected the results.

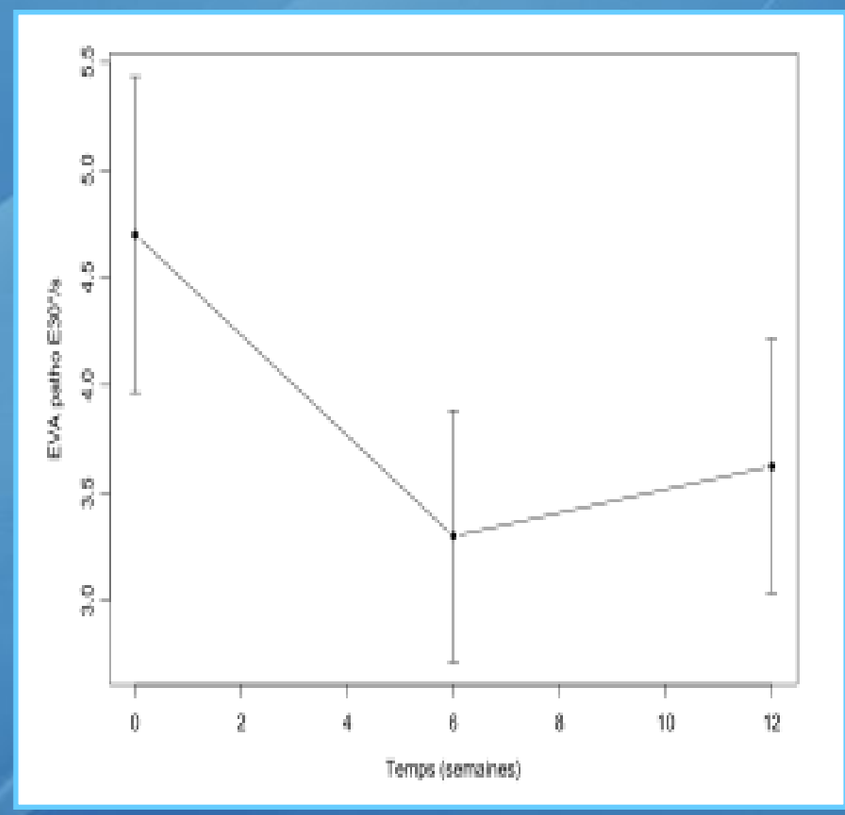
Methods Patients (n=36) were asked to fill in the Victorian Institute of Sports Assessment – Patellar questionnaire (VISA-P) and visual analogue scales (VAS), assessing pain in activities of daily life (ADL), during work and sports, before and after treatment with PRP. Of these patients, 14 had been treated before with cortisone, ethoxysclerol, and/or surgical treatment (group 1), while the remaining patients had not been treated before (group 2).

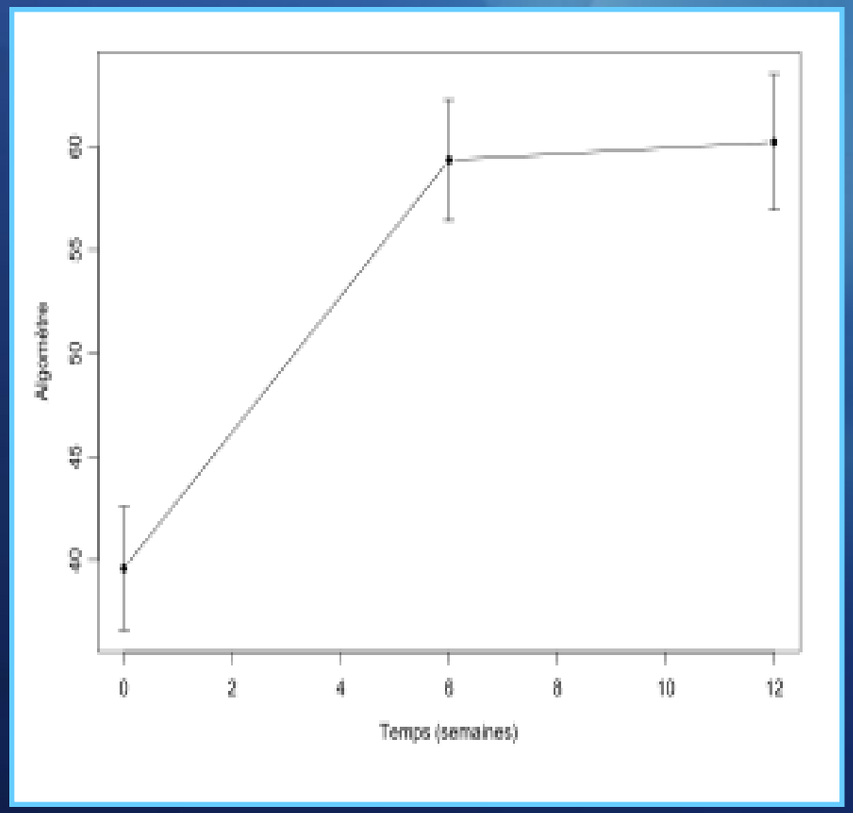
Results Overall, group 1 and group 2 improved significantly on the VAS scales (p<.0.05). However, group 2 also improved on VISA-P (p=.0.003), while group 1 showed less healing potential (p= 0.060). Although the difference between group 1 and group 2 at follow-up was not considered clinically meaningful, over time both groups showed a clinically significant improvement.

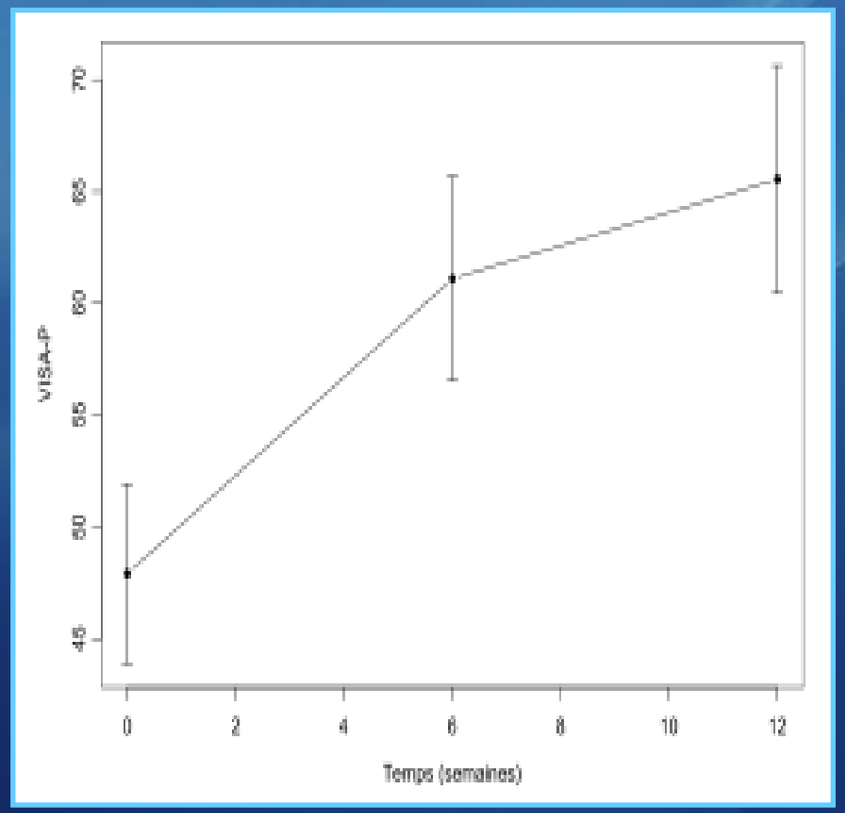
Conclusion After PRP treatment, patients with patellar tendinopathy showed a statistically significant improvement. In addition, these improvements can also be considered clinically meaningful. However, patients who were not treated before with ethoxysclerol, cortisone, and/or surgical treatment showed the improvement.

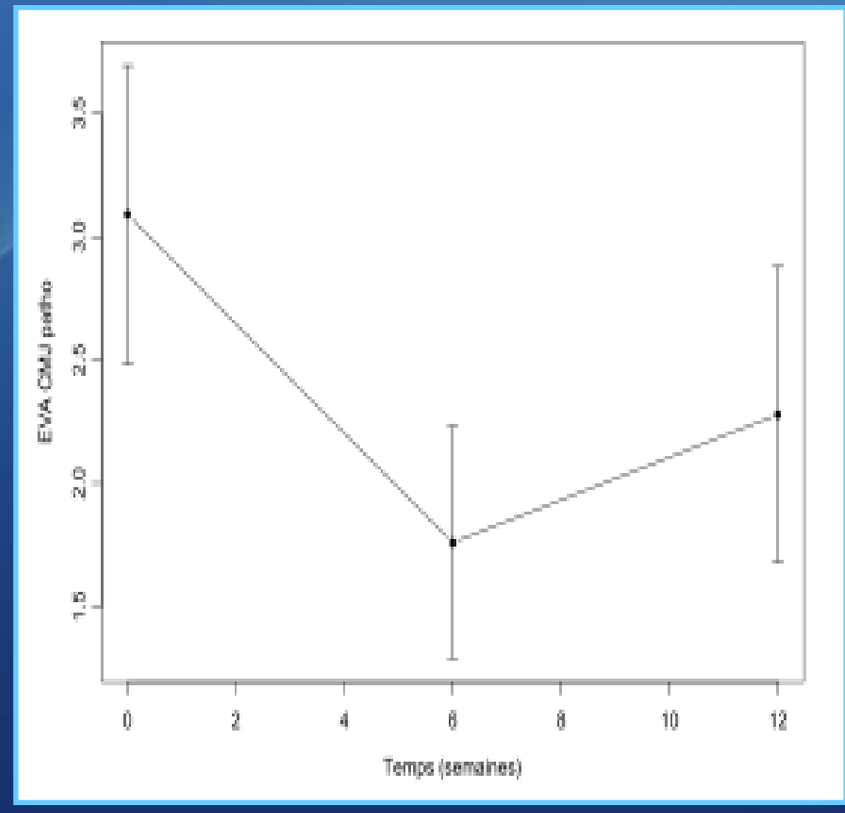












(**Kaux** et al *soumis + poster SFTS « Une infiltration de plasma riche en plaquettes améliore les symptômes des tendinopathies patellaires supérieures »)*

Tendinopathies calcanéennes

Treatment of Achilles tendinopathy with platelet-rich plasma.

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Abstract

Non-insertional Achilles tendinopathy commonly impedes the functioning of active persons. Treatment methods vary, as do their results. The aim of the study was to evaluate the effectiveness of non-insertional Achilles tendinopathy treatment with autologous platelet-rich plasma (PRP). Autologous PRP was injected into the affected Achilles tendon of 14 prospectively selected patients (15 Achilles tendons). Before PRP administration, all patients were evaluated using the American Orthopedic Foot and Ankle Society (AOFAS) scale for the hind foot, and the Victorian Institute of Sport Assessment - Achilles (VISA-A) scale. Ultrasonography (US) and Power-Doppler ultrasonography (PDUS) of the area was also performed. Identical physical and imaging evaluations were performed at 6 weeks, and at 3, 6, and 18 months after injection. During follow up, a significant improvement was observed in the clinical and imaging results. The AOFAS scale improved from a baseline median of 55 points to 96 points at 18 months ($p=0.000655$), while the VISA-A scale improved from a baseline of 24 to 96 ($p=0.000655$) in the final evaluations. During the final evaluation, one subject experienced minor pain following prolonged daily activity, while another subject complained of pain following overloading activity. Local, accurate PRP administration improved symptoms of non-insertional Achilles tendinopathy.

Platelet-Rich Plasma Injection for Chronic Achilles Tendinopathy

A Randomized Controlled Trial

JAMA®
The Journal of the American Medical Association

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Context Tendon disorders comprise 30% to 50% of all activity-related injuries; chronic degenerative tendon disorders (tendinopathy) occur frequently and are difficult to treat. Tendon regeneration might be improved by injecting platelet-rich plasma (PRP), an increasingly used treatment for releasing growth factors into the degenerative tendon.

Objective To examine whether a PRP injection would improve outcome in chronic midportion Achilles tendinopathy.

Design, Setting, and Patients A stratified, block-randomized, double-blind, placebo-controlled trial at a single center (The Hague Medical Center, Leidschendam, the Netherlands) of 54 randomized patients aged 18 to 70 years with chronic tendinopathy 2 to 7 cm above the Achilles tendon insertion. The trial was conducted between August 28, 2008, and January 29, 2009, with follow-up until July 16, 2009.

Intervention Eccentric exercises (usual care) with either a PRP injection (PRP group) or saline injection (placebo group). Randomization was stratified by activity level.

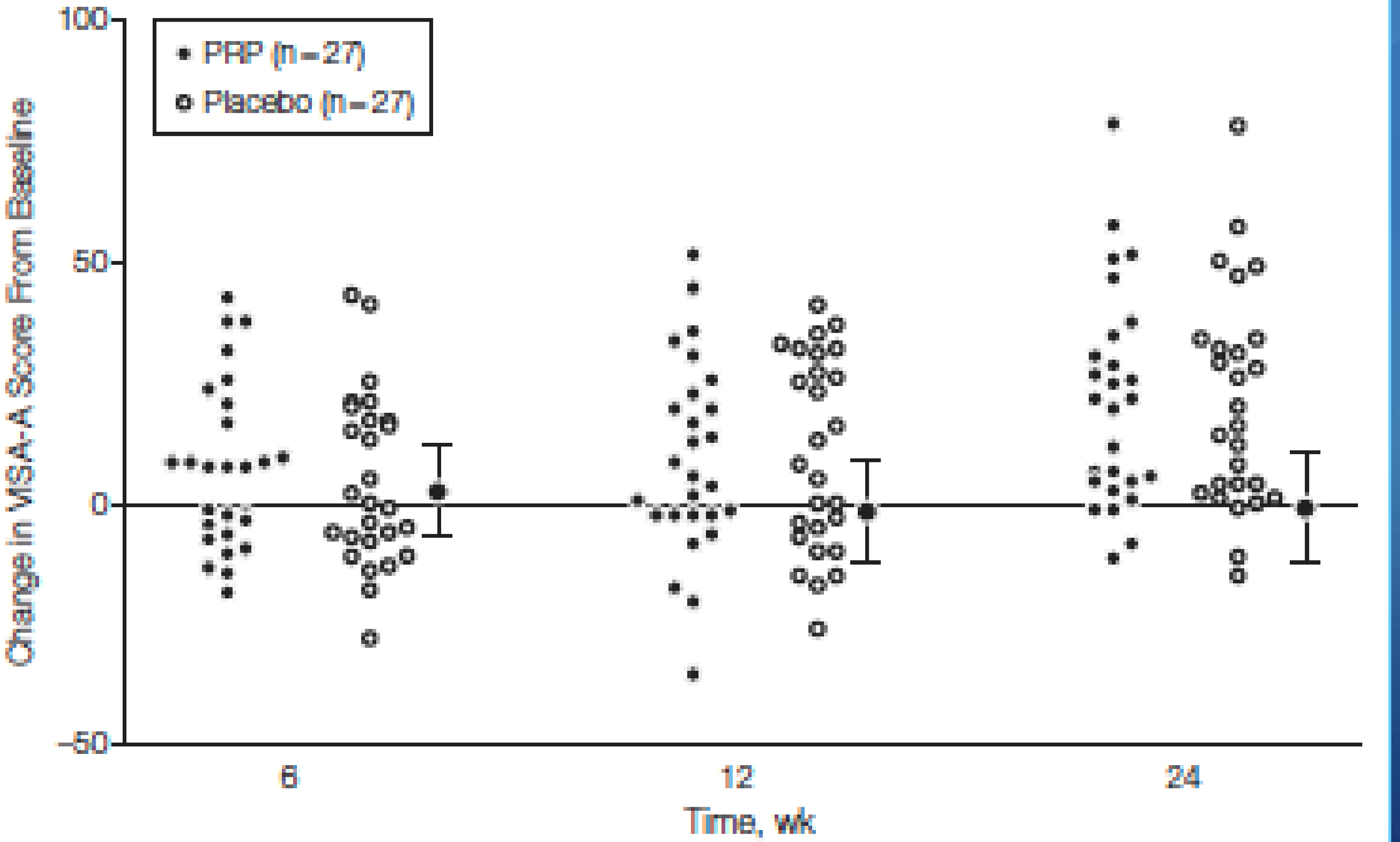
Main Outcome Measures The validated Victorian Institute of Sports Assessment-Achilles (VISA-A) questionnaire, which evaluated pain score and activity level, was completed at baseline and 6, 12, and 24 weeks. The VISA-A score ranged from 0 to 100, with higher scores corresponding with less pain and increased activity. Treatment group effects were evaluated using general linear models on the basis of intention-to-treat.

Results After randomization into the PRP group (n=27) or placebo group (n=27), there was complete follow-up of all patients. The mean VISA-A score improved significantly after 24 weeks in the PRP group by 21.7 points (95% confidence interval [CI], 13.0-30.5) and in the placebo group by 20.5 points (95% CI, 11.6-29.4). The increase was not significantly different between both groups (adjusted between-group difference from baseline to 24 weeks, −0.9; 95% CI, −12.4 to 10.6). This CI did not include the predefined relevant difference of 12 points in favor of PRP treatment.

Conclusion Among patients with chronic Achilles tendinopathy who were treated with eccentric exercises, a PRP injection compared with a saline injection did not result in greater improvement in pain and activity.

Trial Registration clinicaltrials.gov Identifier: NCT00761423

JAMA. 2010;303(2):144-149



No effects of PRP on ultrasonographic tendon structure and neovascularisation in chronic midportion Achilles tendinopathy.

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Abstract

OBJECTIVE: To assess whether a platelet-rich plasma (PRP) injection leads to an enhanced ter with ultrasonographic techniques, in chronic midportion Achilles tendinopathy.

DESIGN: Double-blind, randomised, placebo-controlled clinical trial.

SETTING: Sports medical department of The Hague medical centre.

PATIENTS: 54 patients with chronic midportion Achilles tendinopathy were included.

INTERVENTIONS: Patients were randomised to eccentric exercise therapy with either a PRP inj group).

MAIN OUTCOME MEASUREMENTS: Tendon structure was evaluated by ultrasonographic tissu quantifies tendon structure into four echo-types: echo-types I+II represent organised tendon bun disorganised tendon structure. Colour Doppler ultrasonography was used to measure the degree weeks.

RESULTS: A significant improvement in echo-types I+II was found after 24 weeks within both th but there was no significant between-group difference (95% CI -1.6 to 7.8, p=0.169). After 6 wee PRP group (p=0.001) and the placebo group (p=0.002), but there was no significant between-gro at any point in time.

CONCLUSION: Injecting PRP for the treatment of chronic midportion Achilles tendinopathy does alter the degree of neovascularisation, compared with placebo.

FUNDING: Biomet Biologics LLC, Warsaw, Indiana.

EDUCATION IN BJSM The Journal of Sport & Exercise Medicine

One-Year Follow-up of Platelet-Rich Plasma Treatment in Chronic Achilles Tendinopathy

A Double-Blind Randomized Placebo-Controlled Trial

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Abstract

Background: Achilles tendinopathy is a common disease among both athletes and in the general population in which the use of platelet-rich plasma has recently been increasing. Good evidence for the use of this autologous product in tendinopathy is limited, and data on longer-term results are lacking.

Purpose: To study the effects of a platelet-rich plasma injection in patients with chronic midportion Achilles tendinopathy at 1-year follow-up.

Study Design: Randomized controlled trial; Level of evidence, 1.

Methods: Fifty-four patients, aged 18 to 70 years, with chronic tendinopathy 2 to 7 cm proximal to the Achilles tendon insertion were randomized to receive either a blinded injection containing platelet-rich plasma or saline (placebo group) in addition to an eccentric training program. The main outcome was the validated Victorian Institute of Sports Assessment–Achilles score. Patient satisfaction was recorded and ultrasound examination performed at baseline and follow-up.

Results: The mean Victorian Institute of Sports Assessment–Achilles score improved in both the platelet-rich plasma group and the placebo group after 1 year. There was no significant difference in increase between both groups (adjusted between-group difference, 5.5; 95% confidence interval, −4.9 to 15.8, $P = .292$). In both groups, 59% of the patients were satisfied with the received treatment. Ultrasonographic tendon structure improved significantly in both groups but was not significantly different between groups (adjusted between-group difference, 1.2%; 95% confidence interval, −4.1 to 6.6, $P = .647$).

Conclusion: This randomized controlled trial showed no clinical and ultrasonographic superiority of platelet-rich plasma injection over a placebo injection in chronic Achilles tendinopathy at 1 year combined with an eccentric training program.

Clinical and magnetic resonance imaging outcomes following platelet rich plasma injection for chronic midsubstance Achilles tendinopathy.

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Abstract

BACKGROUND: The successful treatment of chronic mid-substance Achilles tendinopathy remains elusive. Approximately 25% to 50% of patients fail conservative treatment modalities. Scientific evidence has supported the use of platelet rich plasma (PRP) in the tendon healing process, however despite initial promise there is a paucity of clinical data to validate a role for PRP in the treatment of tendon disorders including chronic midsubstance Achilles tendinopathy.

METHODS: As an alternative to operative treatment, our practice offers patients with chronic midsubstance Achilles tendinopathy intratendinous injection of PRP. We retrospectively reviewed all patients treated for Achilles tendinopathy with PRP injection over a 2-year period. Baseline and post injection functional scores including the Foot and Ankle Ability Measure (FAAM), Foot and Ankle Ability Measure - Sports (FAAMS), and the Short Form health survey (SF-8) were examined. Patients also underwent post-injection magnetic resonance imaging (MRI), which were compared to available pre-injection MRI data.

RESULTS: Ten patients were identified for this study. Pre- and postinjection functional outcome scores were available for eight of ten patients. The average SF-8 score improved from 24.9 to 30.0, the average FAAM score improved from 55.4 to 65.8, and the average FAAMS score improved from 14.8 to 17.4. Complete MRI data was available for six patients. Only one in six Achilles tendons demonstrated qualitative MRI improvement post-injection.

CONCLUSION: Patients who received PRP injection demonstrated modest improvement in functional outcome measures, however MRI appearance of diseased Achilles tendons remained largely unchanged following PRP injection.

Discussion

- ***Pas*** de ***consensus*** sur PRP → études difficilement comparables
- ***Controversé*** dans ***littérature***
- ***Populaire*** dans le ***sport***
- ***Retiré*** de la liste des ***produits dopants***

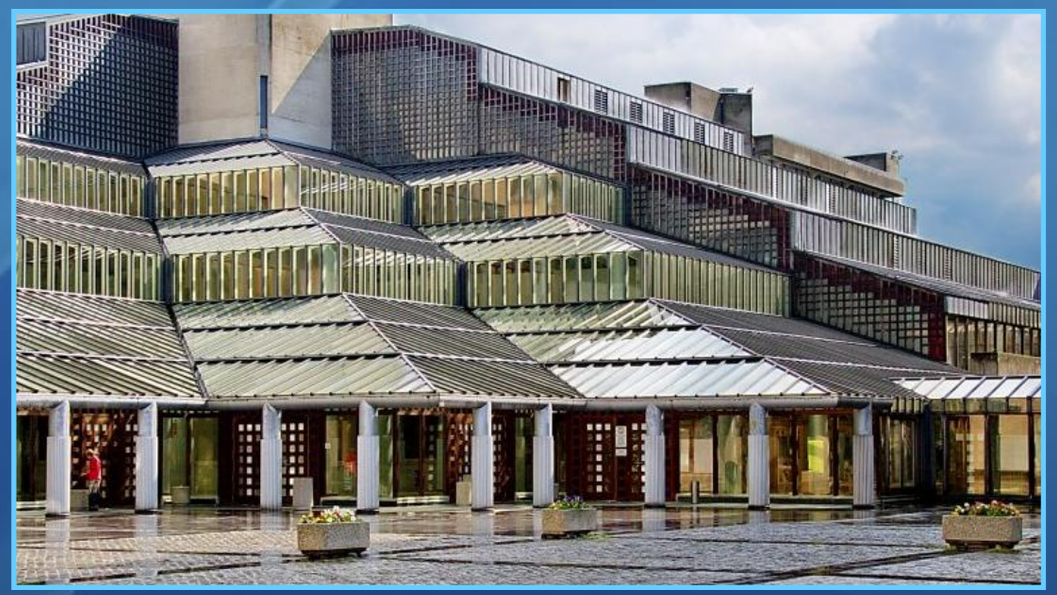
Effets secondaires

- ***Aucun*** décrit dans la ***littérature***
- 1 cas de ***réaction inflammatoire exhubérante*** chez patient diabétique type 1
(**Kaux et al**, *soumis*)

Conclusion

- ***PRP → facteurs*** de ***croissance***
- Facile à préparé, relativement ***peu invasif*** et «bon marché»
- Actuellement ***controversé*** et ***peu d'évidences*** cliniques tangibles
- RCT sont nécessaires !
- ***Consensus sur le PRP !***

Merci de votre attention !



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