

Evidence based medicine

Tendon and platelet-rich plasma (PRP)

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Physical Medicine and Sports Medicine Department
SPORTS²



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Introduction

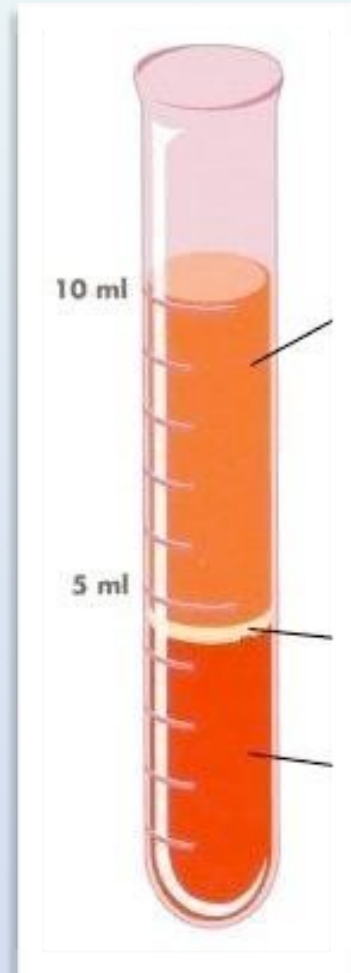
- Tendinopathies → chronic
- Classical treatments → inefficient ?
- Development of new therapeutics:
 - NO patches
 - polidocanol,
 - hyaluronic acid...
- Platelet-rich plasma = PRP → tissue healing

Introduction

- *Popular in sport*
- *Removed from the doping list of the WADA*
- *Controversies in literature*
- *No general agreement*



- Centrifugation of *autologous* blood
- *High concentration of platelets* (3-10x)





Blood

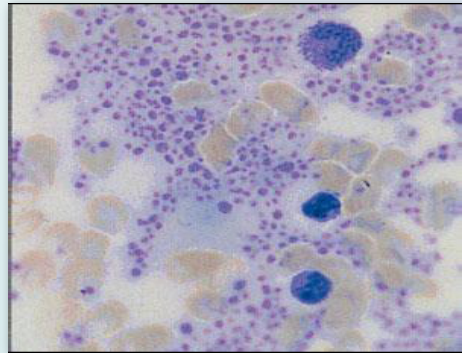
45% cellular
elements

55% plasma

95% RC

4% platelets

1% WC



PRP

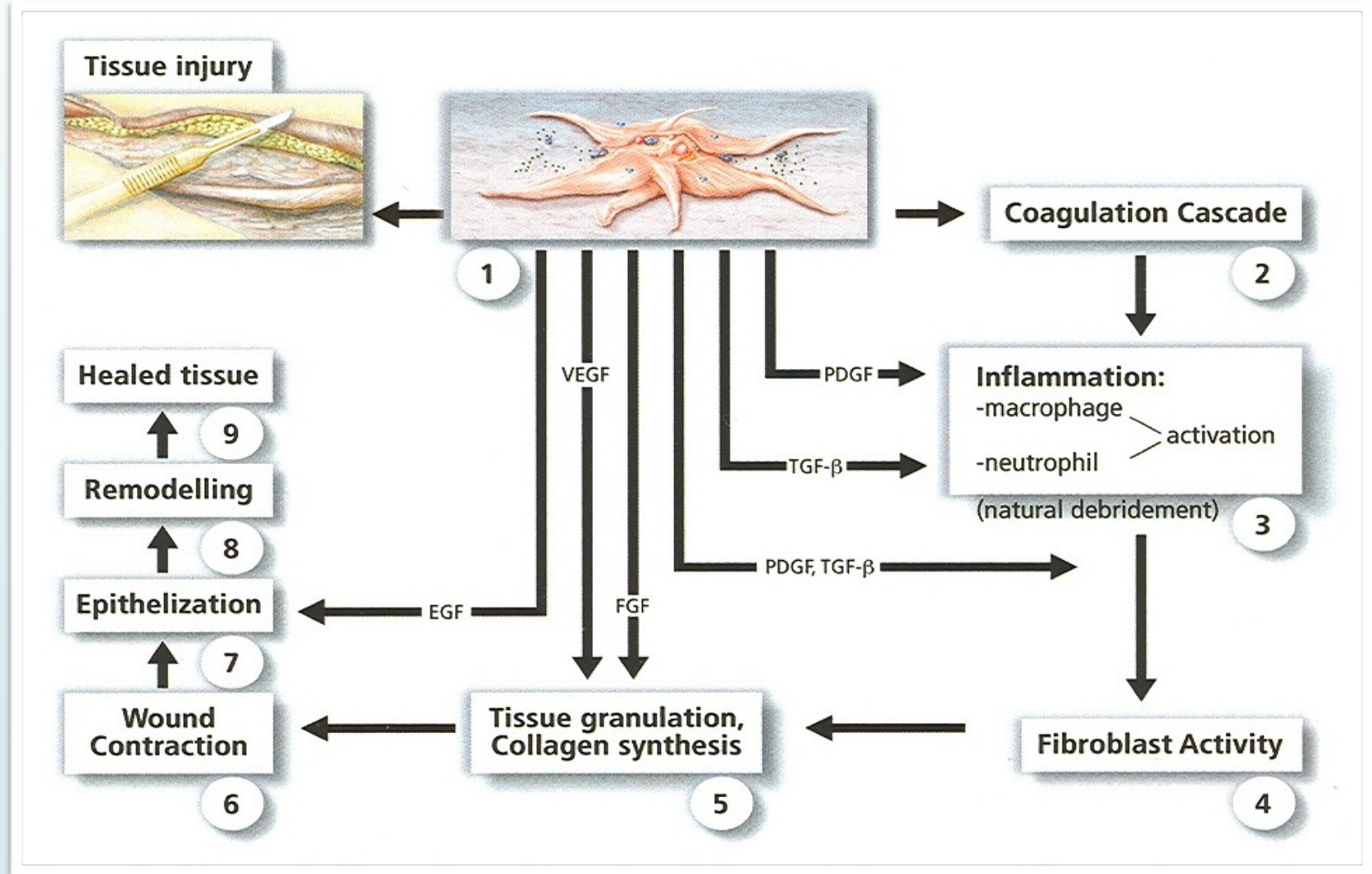
45% cellular
elements

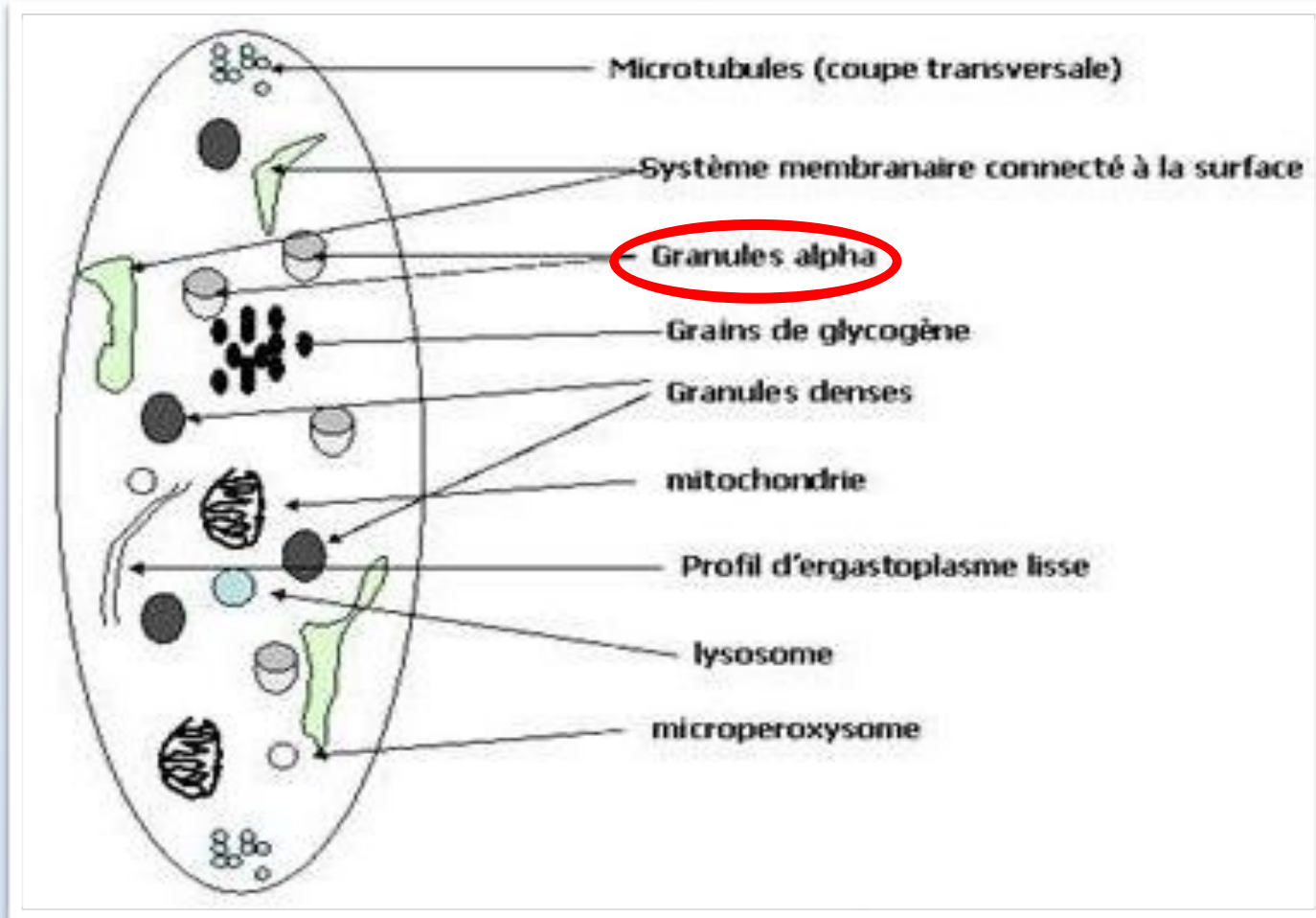
55% plasma

> 95% plaquettes

< 4% RC

< 1% WC





- **PDGF** : stimulation production other GF
- **TGF- β** : cells proliferation and migration, collagen synthesis
- **FGF** : angiogenesis, cells proliferation and migration
- **VEGF** : angiogenesis
- **HGF** : cells proliferation and migration, angiogenesis
- **IGF-1** : cells proliferation and migration, collagen and ECM synthesis



Preclinical studies

- Tendons = *small metabolic index*
- GF → tenocyte proliferation, *collagen synthesis*, stimulation of angiogenesis, analgesic properties (Anitua 2009; Bosch 2011)
- *Stimulation and acceleration of tissue regeneration* (Virchenko 2006; Bosch 2011; Kaux 2012)
- *Mechanical loads* required to obtain optimal tissue quality (Virchenko 2006; Kaux 2012)

- Each GF = *specific action* during healing process (Molloy 2003; Anitua 2007)
- *Improve cicatricial process* and decrease time of cicatrization:
 - *differentiation* of cells from circulation (Anitua 2006 & 2007; Kajikawa 2008)
 - improve MMPs-3 expression → *remodeling ECM* (de Mos 2008)
 - *improve initial stages* of healing (Anitua 2006 & 2007; Kajikawa 2008; Kaux 2012)
 - improve *type I collagen fiber synthesis and organisation*, neovascularisation (Lyras 2009; Kajikawa 2008; Mishra 2009; Kaux 2012)
 - *better maturation* of the tendinous cal (Aspenberg 2004; Virchenko 2006; Kaux 2012)

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

Wound Repair and Regeneration

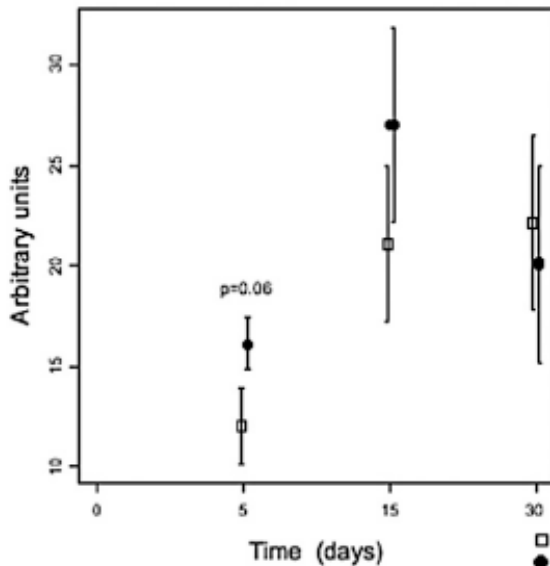
Effects of platelet-rich plasma (PRP) on the healing of Achilles tendons of rats

Jean-François Kaux, MD¹; Pierre V. Drion, DVM, PhD²; Alain Colige, PhD²; Frédéric Pascon, PhD⁴; Vincent, Libertiaux, PhD⁴; Audrey Hoffmann, BS³; Lauriane Janssen, MSc³; Antoine Heyers, MSc³; Betty V. Nusgens, PhD⁵; Caroline Le Goff, Pharm Clin Biol⁶; André Gothot, MD, PhD⁵; Serge Cescotto, PhD⁴; Jean-Olivier Defraigne, MD, PhD⁶; Markus Rickert, MD, PhD⁷; Jean-Michel Crielaard, MD, PhD¹

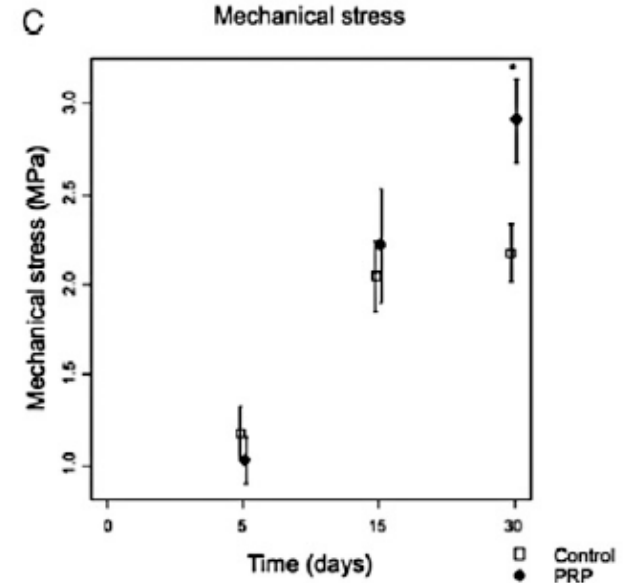
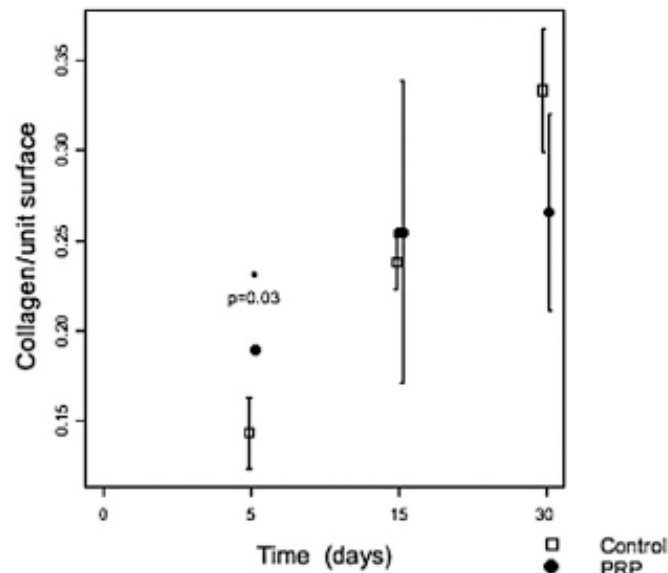
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7. Department of Orthopaedic Surgery, University of Heidelberg, Heidelberg, Germany

Wound Rep Reg (2012) 20 748–756

A Semiquantification of the LG staining



B Collagen concentration



Clinical studies

- *Chronic* tendinopathies
- Initiate an *acute inflammatory reaction* that quickly moves on to the *proliferative phase*
- **NOT** to be used for acute tendinitis or tenosynovitis



Acta Orthop. Belg., 2013, **79**, 10-15

Platelet-rich plasma application in the management of chronic tendinopathies

Jean-François KAUX, Jean-Michel CRIELAARD

From the University and University Hospital of Liège, Belgium

Epicondylitis

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

Strong evidence against platelet-rich plasma injections for chronic lateral epicondylar tendinopathy: a systematic review

Robert-Jan de Vos,^{1,2,3} Johann Windt,⁴ Adam Weir¹

British Journal of
Sports Medicine

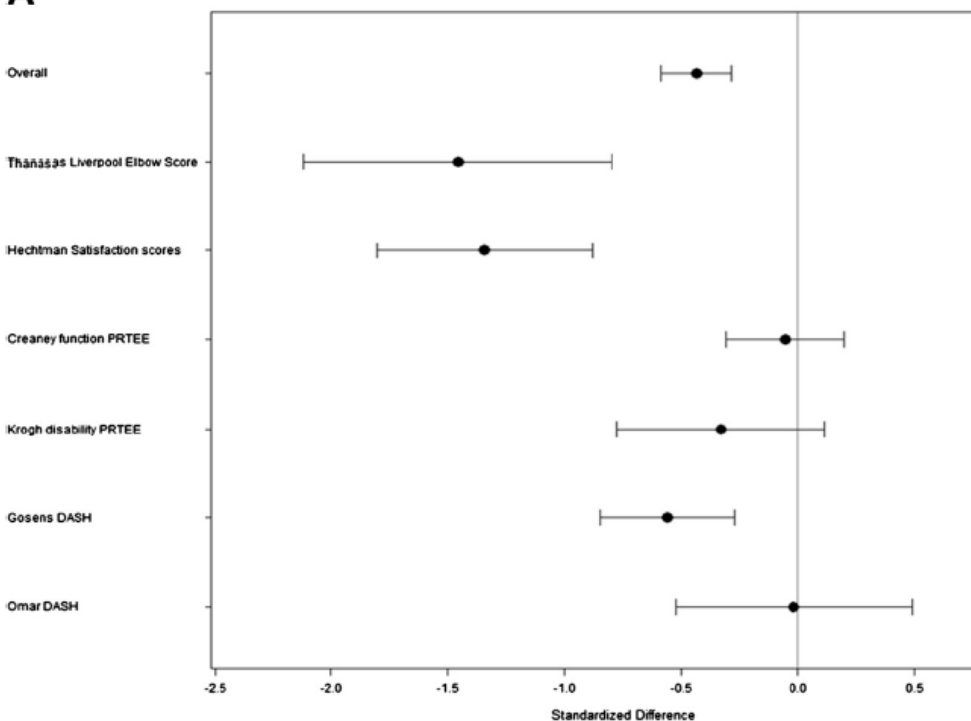
- 6 studies
 - **PRP vs steroids ; following 1 year** (Peerbooms 2010)
 - **PRP vs bupivacaine ; following 6 months** (Mishra 2013)
 - **PRP vs steroids ; following 6 weeks** (Omar 2012)
 - **PRP vs autologous blood ; following 6 months** (Thanassas 2011 ; Creaney 2011)
 - **PRP vs steroids vs saline ; following 3 months** (Krogh 2013)

The Effect of Platelet-Rich Plasma on Clinical Outcomes in Lateral Epicondylitis

Zafar Ahmad, M.Phil., M.R.C.S., M.B.B.S., B.Sc., Roger Brooks, Ph.D.,
 Sertaz-Niel Kang, F.R.C.S., Holly Weaver, B.A., Ian Nunney, M.Sc., B.Sc.,
 Graham Tytherleigh-Strong, M.D., F.R.C.S., and Neil Rushton, M.D., F.R.C.S

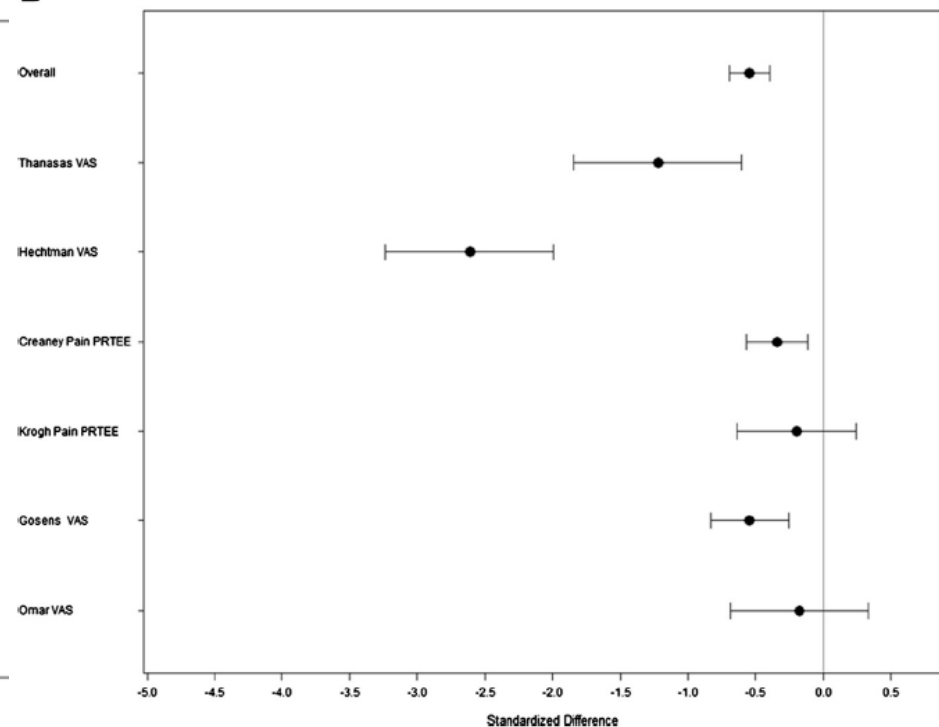
A

Forest Plot Of Standardized Mean Differences for Function



B

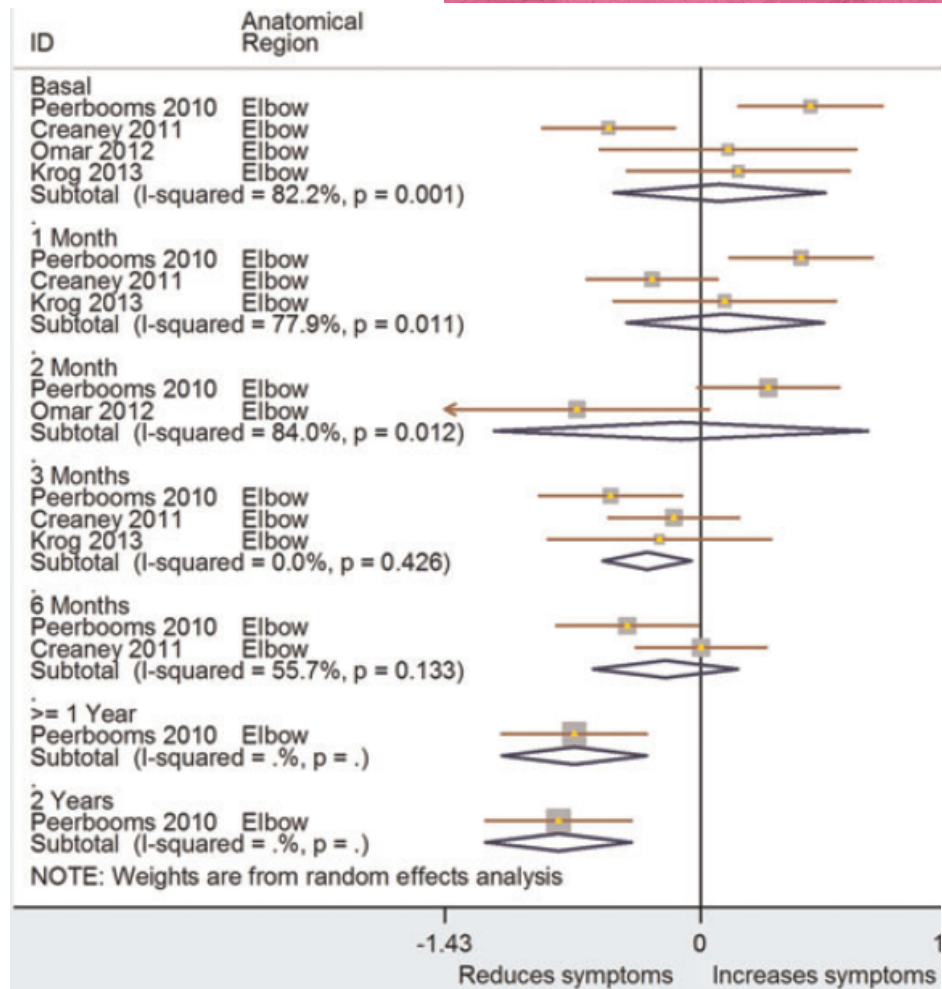
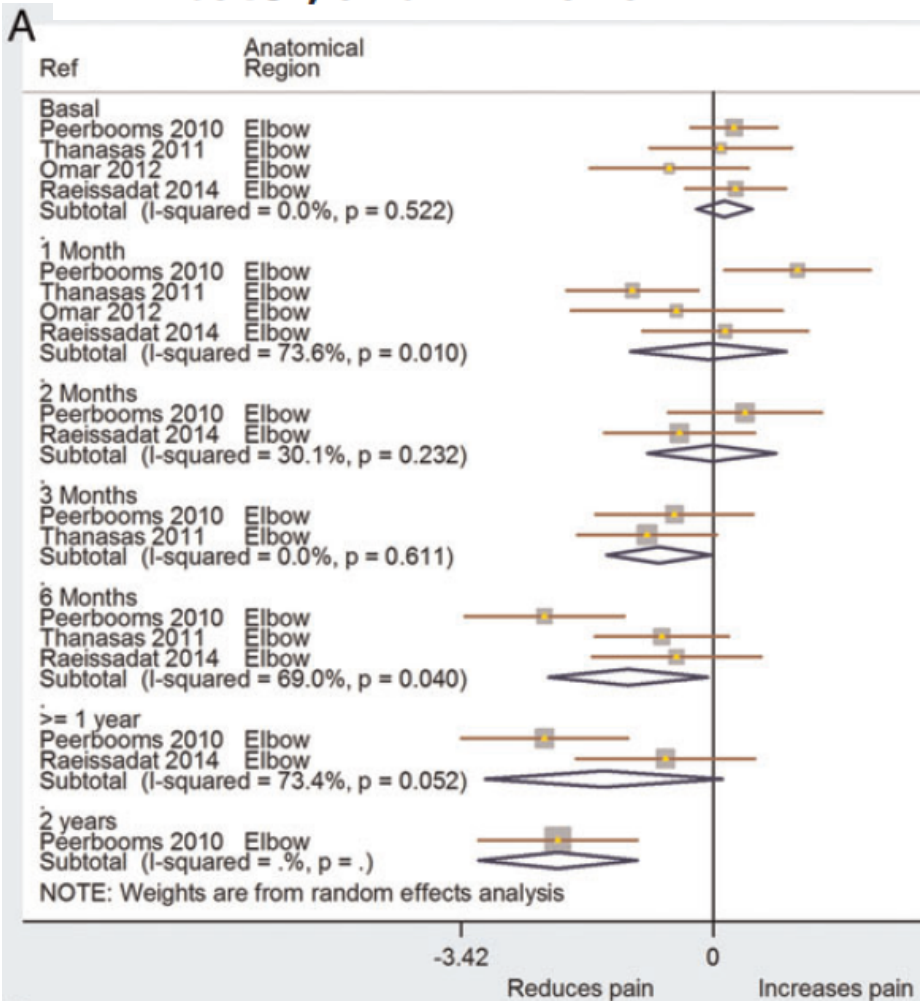
Forest Plot Of Standardized Effect Sizes for Pain



Platelet-rich plasma in the conservative treatment of painful tendinopathy: a systematic review and meta-analysis of controlled studies

I. Andia[†], P. M. Latorre[‡], M. C. Gomez[‡], N. Burgos-Alonso[‡],
M. Abate[§], and N. Maffulli^{††,*}

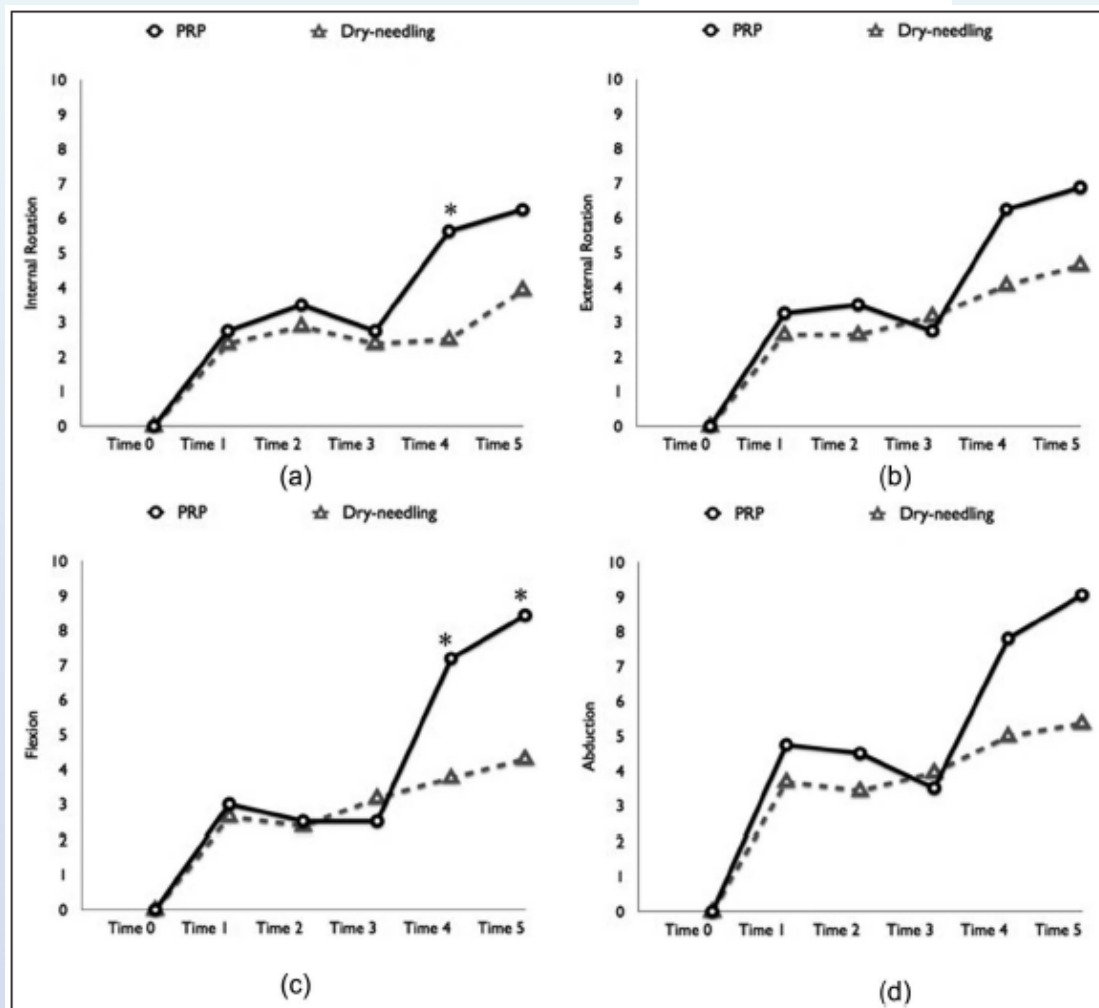
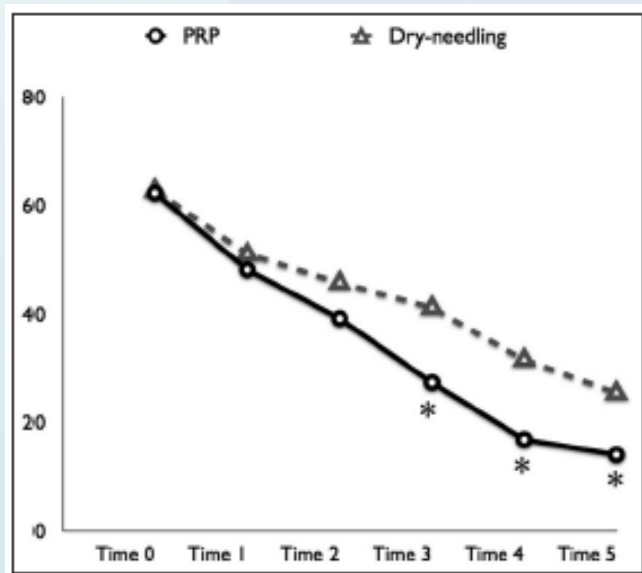
BRITISH MEDICAL JOURNAL



Rotator cuff

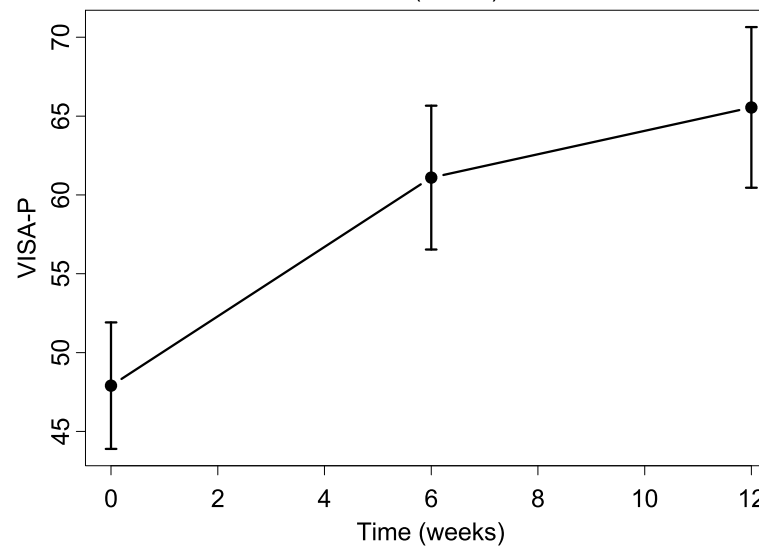
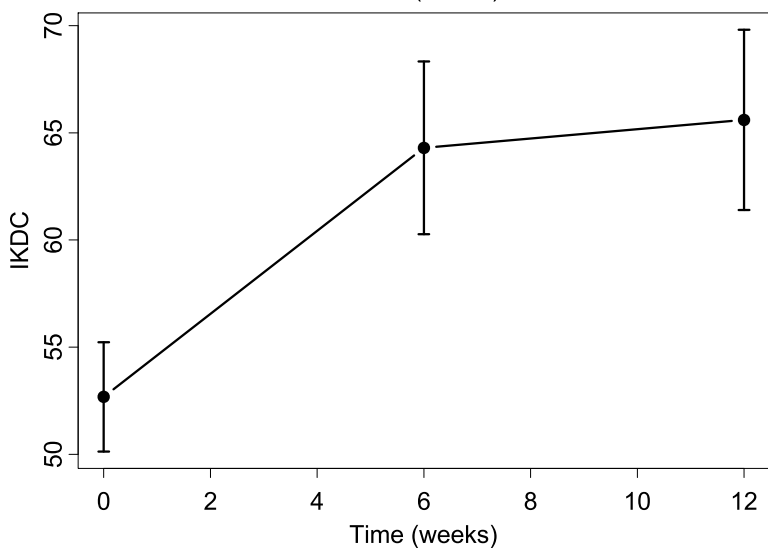
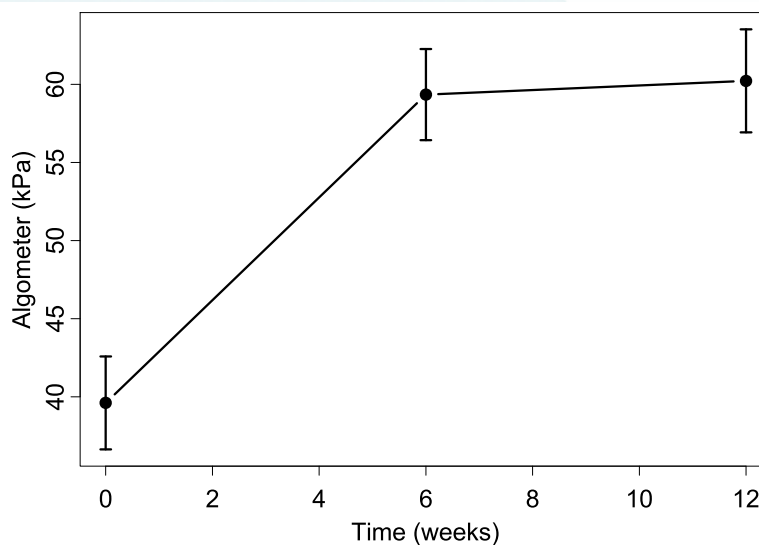
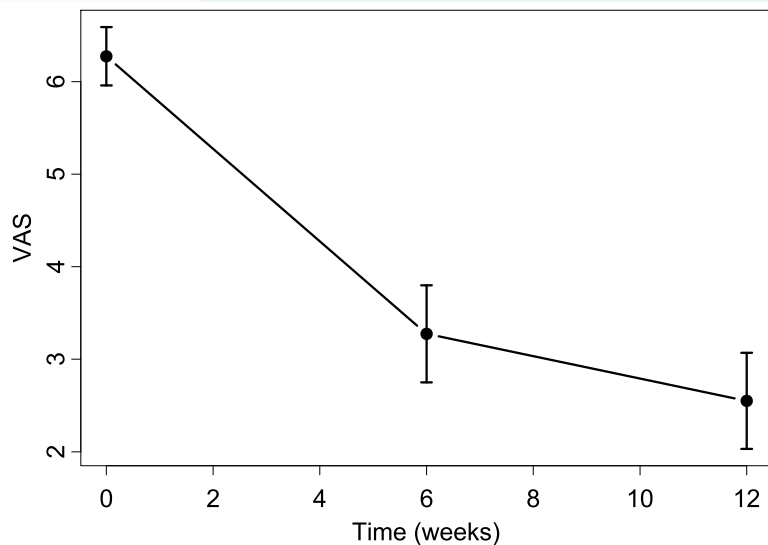
Comparison of the therapeutic effects of ultrasound-guided platelet-rich plasma injection and dry needling in rotator cuff disease: a randomized controlled trial

Dong-wook Rha¹, Gi-Young Park², Yong-Kyun Kim³, Min Tae Kim³ and Sang Chul Lee³



Patellar tendinopathy

Patellar tendinopathies



- Patients with best improvement → younger (24.7 vs 32.2 y.o.)
- VAS \leq I
- significant increase of IKDC score
- significant improvement of pain during isokinetic evaluation and optojump
- 70% return to sport (50% same level)



Platelet-Rich Plasma Versus Focused Shock Waves in the Treatment of Jumper's Knee in Athletes

Mario Vetrano,^{*†} MD, Anna Castorina,[†] MD, Maria Chiara Vulpiani,[†] MD, Rossella Baldini,[‡] PhD, Antonio Pavan,[§] MD, and Andrea Ferretti,^{||} MD
Investigation performed at the Sant'Andrea Hospital, Sapienza University of Rome, Rome, Italy



Background: Tendinopathies represent a serious challenge for orthopaedic surgeons involved in treatment of athletes.

Purpose: To compare the effectiveness and safety of platelet-rich plasma (PRP) injections and focused extracorporeal shock wave therapy (ESWT) in athletes with jumper's knee.

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

Methods: Forty-six consecutive athletes with jumper's knee were selected for this study and randomized into 2 treatment groups: 2 autologous PRP injections over 2 weeks under ultrasound guidance (PRP group; n = 23), and 3 sessions of focused extracorporeal shock wave therapy (2,400 impulses at 0.17-0.25 mJ/mm² per session) (ESWT group; n = 23). The outcome measures were Victorian Institute of Sports Assessment-Patella (VISA-P) questionnaire, pain visual analog scale (VAS), and modified Blazina scale. A reviewer who was blinded as to the group allocation of participants performed outcome assessments before treatment and at 2, 6, and 12 months after treatment. Nonparametric tests were used for within-group (Friedman/Wilcoxon test) and between-group (Kruskal-Wallis/Fisher test) testing, and the significance level was set at .05.

Results: The 2 groups were homogeneous in terms of age, sex, level of sports participation, and pretreatment clinical status. Patients in both groups showed statistically significant improvement of symptoms at all follow-up assessments. The VISA-P, VAS, and modified Blazina scale scores showed no significant differences between groups at 2-month follow-up ($P = .635$, $.360$, and $.339$, respectively). The PRP group showed significantly better improvement than the ESWT group in VISA-P, VAS scores at 6- and 12-month follow-up, and modified Blazina scale score at 12-month follow-up ($P < .05$ for all).

Conclusion: Therapeutic injections of PRP lead to better midterm clinical results compared with focused ESWT in the treatment of jumper's knee in athletes.

Keywords: jumper's knee; platelet-rich plasma; extracorporeal shock wave therapy; tendinopathy/therapy

Achilles tendinopathy

Platelet-Rich Plasma Injection for Chronic Achilles Tendinopathy

A Randomized Controlled Trial

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

Robert J. de Vos, MD

Adam Weir, MBBS

Hans T. M. van Schie, DVM, PhD

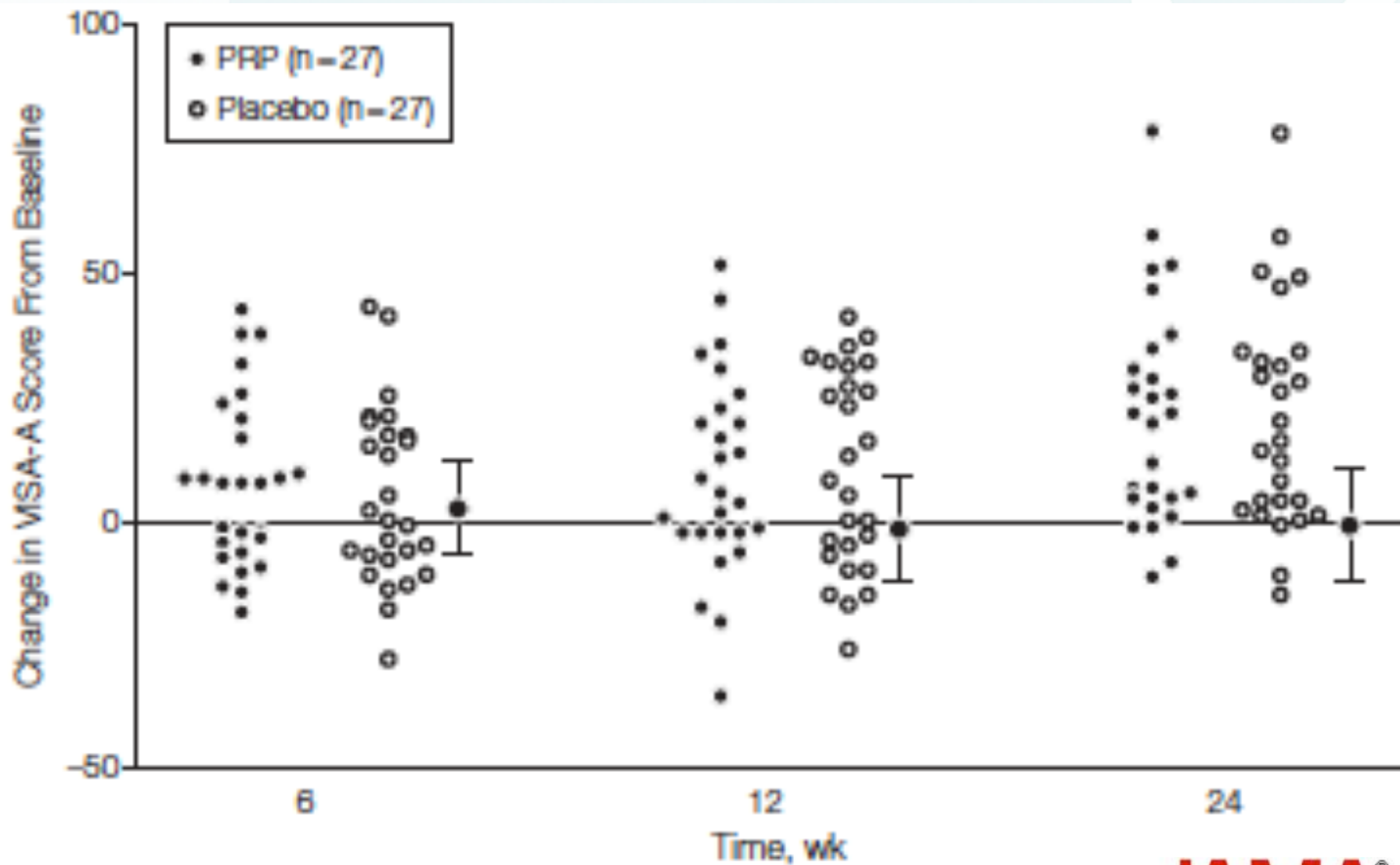
Sita M. A. Bierma-Zeinstra, PhD

Jan A. N. Verhaar, MD, PhD

Harrie Weinans, PhD

Johannes L. Tol, MD, PhD





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

de Vos RJ, Weir A, Tol JL, Verhaar JA, Weinans H, van Schie HT.

Department of Orthopaedic Surgery, Erasmus Medical Centre, Rotterdam, The Netherlands. r.devos@erasmusmc.nl

Abstract

OBJECTIVE: To assess whether a platelet-rich plasma (PRP) injection leads to an enhanced tendon structure 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 injection (PRP group) or placebo (placebo group).

MAIN OUTCOME MEASUREMENTS: Tendon structure was evaluated by ultrasonographic tissue Doppler imaging (TDI). TDI quantifies tendon structure into four echo-types: echo-types I+II represent organised tendon structure, while echo-types III+IV represent disorganised tendon structure. Colour Doppler ultrasonography was used to measure the degree of neovascularisation at any point in time.

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

CONCLUSION: Injecting PRP for the treatment of chronic midportion Achilles tendinopathy does not alter the degree of neovascularisation, compared with placebo.

FUNDING: Biomet Biologics LLC, Warsaw, Indiana.

One-Year Follow-up of Platelet-Rich Plasma Treatment in Chronic Achilles Tendinopathy A Double-Blind Randomized Placebo-Controlled Trial

Suzan de Jonge, MD^{1,2}, Robert J. de Vos, MD, PhD¹, Adam Weir, MD³, Hans T. M. van Schie, DVM, PhD^{1,4}, Sita M. A. Bierma-Zeinstra, PhD^{1,5}, Jan A. N. Verhaar, MD, PhD¹, Harrie Weinans, PhD^{1,6} and Johannes L. Tol, MD, PhD¹

Author Affiliations

¹ Suzan de Jonge, MD, Departments of Orthopaedics, Erasmus University Medical Center, PO Box 2040, 3000 CA Rotterdam, the Netherlands (e-mail: s.dejonge@erasmusmc.nl).

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.

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Medicine



- Critics:

- no eccentric treatment before study
- injection could cause local bleeding
- change in pressure-volume related to the presence of saline solution
- relatively invasive for control groups
- PRP quality may not have been optimal

Other localisations

Platelet-rich Plasma as an Effective Treatment for Proximal Hamstring Injuries

ROBERT J. WETZEL, MD; RONAK M. PATEL, MD; MICHAEL A. TERRY, MD

Proximal hamstring injuries can be disabling, and several traditional conservative treatments, including physiotherapy and nonsteroidal anti-inflammatory drugs, have been inconsistent. Corticosteroid injections have demonstrated success but can adversely affect local tissues. Platelet-rich plasma (PRP) has emerged as a safe, effective treatment for several orthopedic pathologies. The authors propose a PRP injection at the muscle origin as a novel treatment for proximal hamstring injuries.

A retrospective review yielded 15 patients with 17 proximal hamstring injuries. Twelve injuries failed traditional conservative treatment and were ultimately treated with a PRP injection at the hamstrings muscle origin. Five patients were treated with traditional conservative treatment alone. Analysis included pre- and posttreatment visual analog scale scores, Nirschl Phase Rating Scale scores, and return to sport. No significant difference existed between the groups' pretreatment visual analog scale scores ($P=.28$) and Nirschl Phase Rating Scale scores ($P=.15$) and their posttreatment visual analog scale scores ($P=.38$) and Nirschl Phase Rating Scale scores ($P=.22$). The PRP group demonstrated a reduction in visual analog scale scores ($P<.01$) and Nirschl Phase Rating Scale scores ($P<.01$), but the traditional conservative treatment group did not demonstrate the same reduction ($P=.06$ and $.06$, respectively). All athletes returned to their desired activity level with no major complications.



Outcomes After Ultrasound-Guided Platelet-Rich Plasma Injections for Chronic Tendinopathy: A Multicenter, Retrospective Review

Kenneth Mautner, MD, Ricardo E. Colberg, MD, Gerard Malanga, MD, Joanne P. Borg-Stein, MD, Kimberly G. Harmon, MD, Aisha S. Dharamsi, MD, Samuel Chu, MD, Paul Homer

Objective: To determine whether ultrasound-guided platelet-rich plasma (PRP) injections are an effective treatment for chronic tendinopathies.

Design: A retrospective, cross-sectional survey.

Setting: Four academic sports medicine centers from across the United States.

Patients: A total of 180 men and women between the ages of 18 and 75 years who received ultrasound-guided PRP injections for tendinopathy refractory to conventional treatments.

Interventions: Survey on satisfaction and functional outcome.

Main Outcome Measurements: Perceived improvement in symptoms at least 6 months after treatment, perceived change in visual analog scale score, assessment of functional pain, and overall satisfaction.

Results: On average, patients were 48 years old, had symptoms for a median of 18 months before treatment, and answered the survey on average 15 months after treatment. Overall, 82% of patients indicated moderate to complete improvement in symptoms. The most common injection sites were the lateral epicondyle, Achilles, and patellar tendons. Other sites treated included the rotator cuff, hamstring, gluteus medius, and medial epicondyle, among others. Furthermore, 60% of patients received only 1 injection, 30% received 2 injections, and 10% received 3 or more injections. Patients' perceived decrease in visual analog scale score was 75%, from 7.0 ± 1.8 to 1.8 ± 2.0 (-5.2 , SD 2.7, 95% confidence interval -5.65 to -4.86 , $P < .0001$). In addition, at follow-up, 95% of patients reported having no pain at rest that disrupted their activities of daily living and 68% reported no pain during activities. A total of 85% of patients were satisfied with the procedure.

Conclusions: In this retrospective study, in which we evaluated administration of PRP for chronic tendinopathy, we found that the majority of patients reported a moderate ($>50\%$) improvement in pain symptoms.

PM&R

Platelet-rich plasma injections for chronic plantar fasciopathy: a systematic review

F. Franceschi[†], R. Papalia[†], E. Franceschetti[†], M. Paciotti[†], N. Maffulli^{‡,§,*}, and V. Denaro[†]

BRITISH MEDICAL BULLETIN

Abstract

Introduction: There is an increasing interest in platelet-rich plasma (PRP) injection as a treatment for chronic plantar fasciopathy (PF). We wished to evaluate the evidence for the use of PRP in PF/fasciitis.

Sources of data: We performed a systematic review on the effects of PRP in PF. In June 2014, we searched Medline, Cochrane, CINAHL and Embase databases using various combinations of the commercial names of each PRP preparation and 'plantar' (with its associated terms). We only included prospectively designed studies in humans.

Areas of agreement: Eight articles met the inclusion criteria, three of them were randomized. All studies yielded a significantly greater improvement in symptoms between baseline and last follow-up assessment. None of the papers recorded major complications.

Areas of controversy: Only three randomized studies were identified; none of them had a true controlled group treated with placebo and one of the three studies had a very short (6 week) follow-up. A non-randomized study evaluating PRP versus corticosteroids (CCS) injections, and a randomized controlled trial comparing PRP and dextrose prolotherapy reported no statistical significant differences at 6 months. Most studies did not have a control group and imaging evaluation.

Growing points and areas for research: Evidence for the use of PRP in PF shows promising results, and this therapy appears safe. However, the number of studies available is limited and randomized placebo-controlled studies are required. Characterizing the details of the intervention and standardizing the outcome scores would help to better document the responses and optimize the treatment.

Platelet-Rich Plasma as a Treatment for Patellar Tendinopathy

A Double-Blind, Randomized Controlled Trial

Jason L. Dragoo,^{*†‡} MD, Amy S. Wasterlain,^{†‡} MD, Hillary J. Braun,[†] BA, and Kevin T. Nead,[†] MPhil
Investigation performed at Stanford University, Redwood City, California, USA

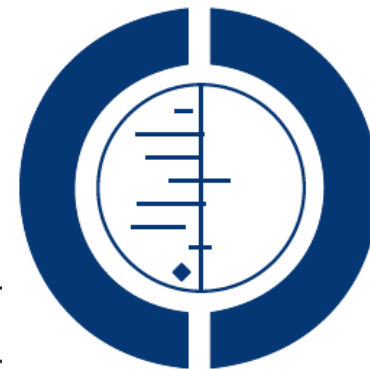
Platelet-rich therapies for musculoskeletal soft tissue injuries (Review)

Moraes VY, Lenza M, Tamaoki MJ, Faloppa F, Belloti JC

Platelet Rich Placebo?

Evidence for Platelet Rich Plasma in the Treatment of Tendinopathy and Augmentation of Tendon Repair

Michael P. Hall, M.D., James P. Ward, M.D., and Dennis A. Cardone, D.O.

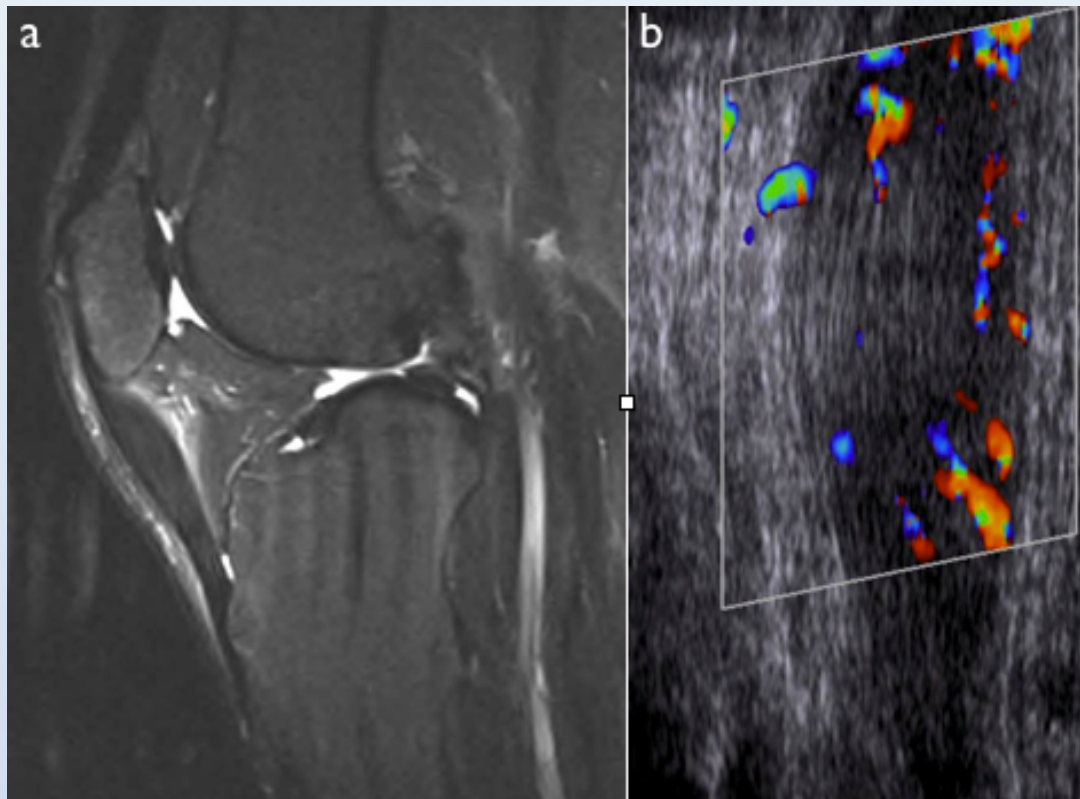


THE COCHRANE
COLLABORATION®

Strong evidence against platelet-rich plasma injections for chronic lateral epicondylar tendinopathy: a systematic review

Robert-Jan de Vos,^{1,2,3} Johann Windt,⁴ Adam Weir¹

- *Potential side effect: exuberant inflammatory reaction* (Kaux 2014)



Evidence based medicine ?

- Undertake a precise diagnosis
- Research and correct metabolic factors
 - diabetes
 - hyperuricemia
 - hypercholesterolemia
 - dysthyroidism

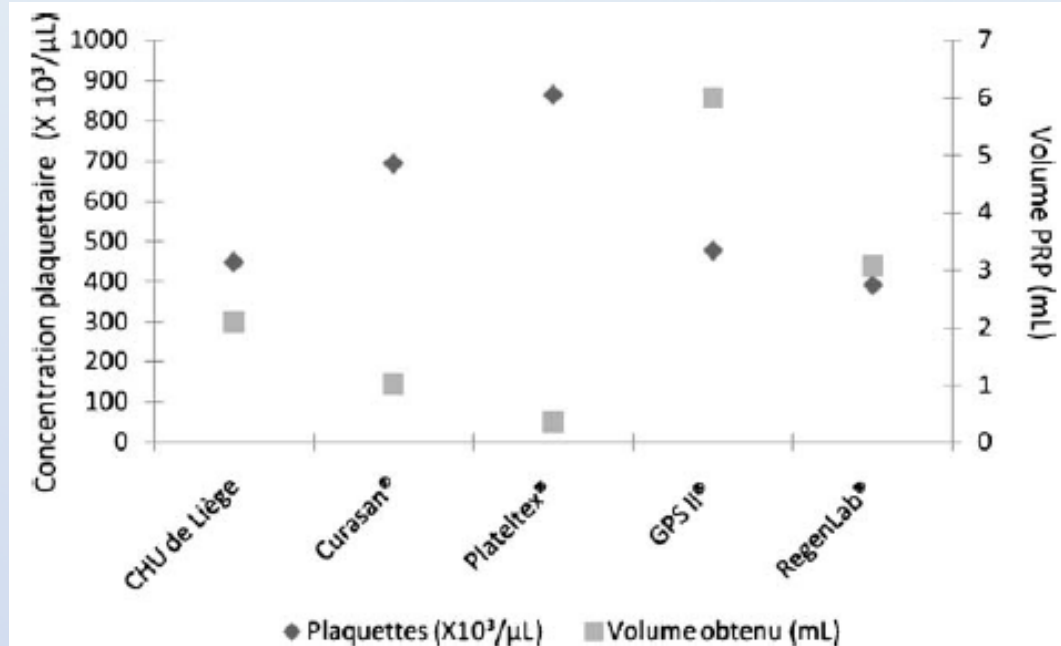
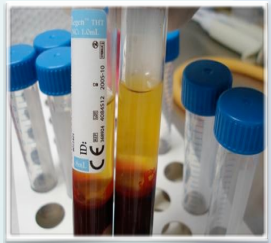
- Chronic corporeal tendinopathies resistant to conservative therapies
 - without bony impingement
- Enthesopathies
- No inflammatory pathologies

- Autologous
- Antibacterial effect
- No anesthetics
- No NSAIDs
- Ovoid in patients with metaplasia lesions or exposed to carcinoid agents
- US guidance

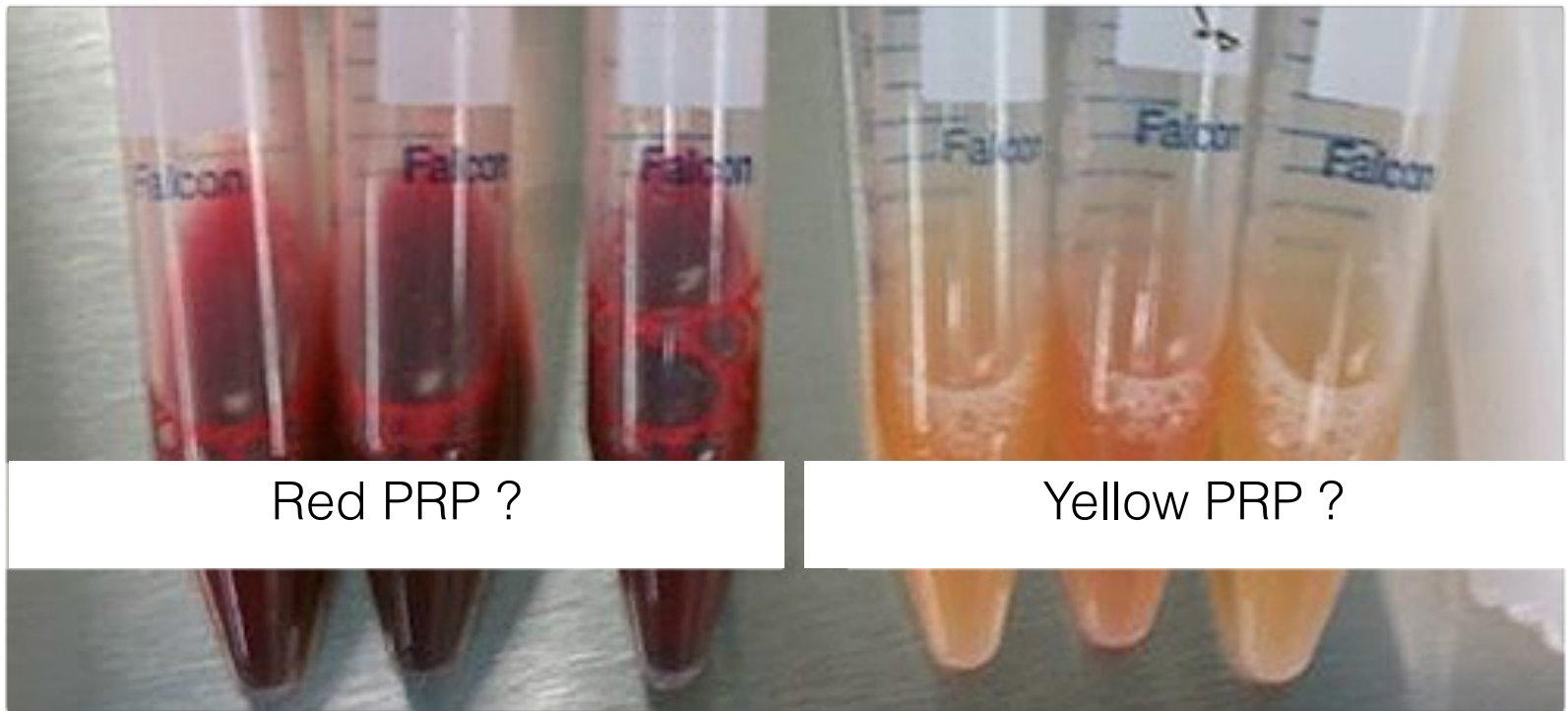


Preparation

- Many varied techniques → different PRP
 - variation of *platelet concentration*
 - presence or not of *erythrocytes* and *leucocytes*



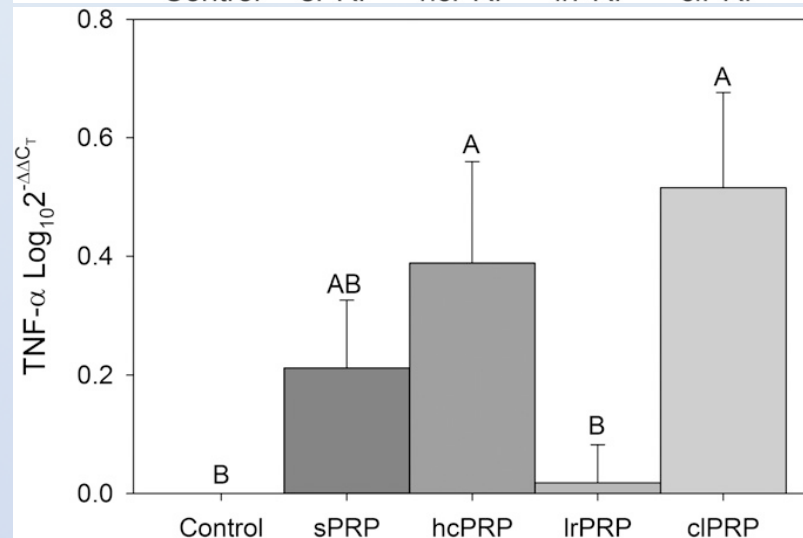
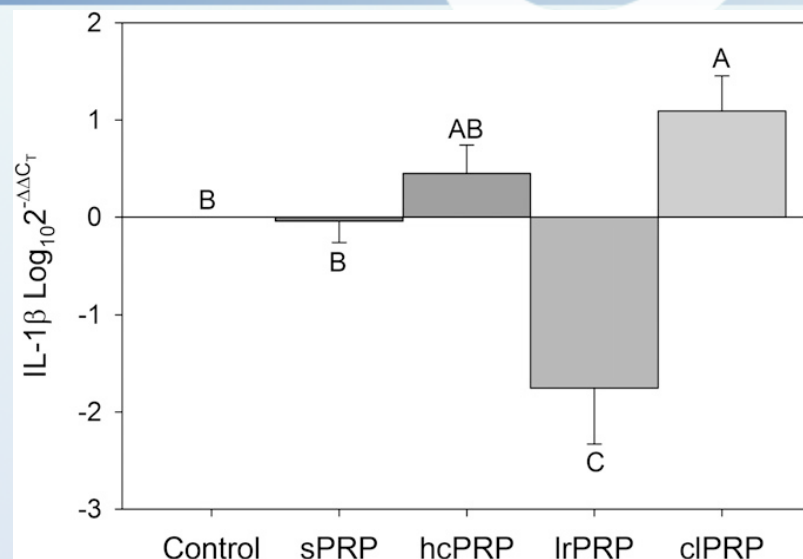
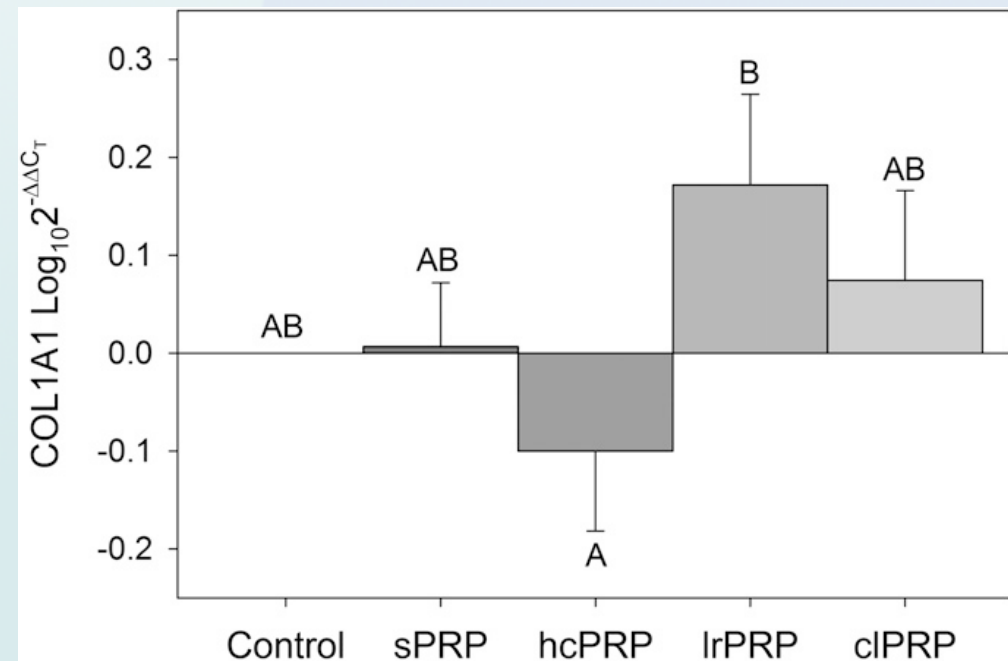
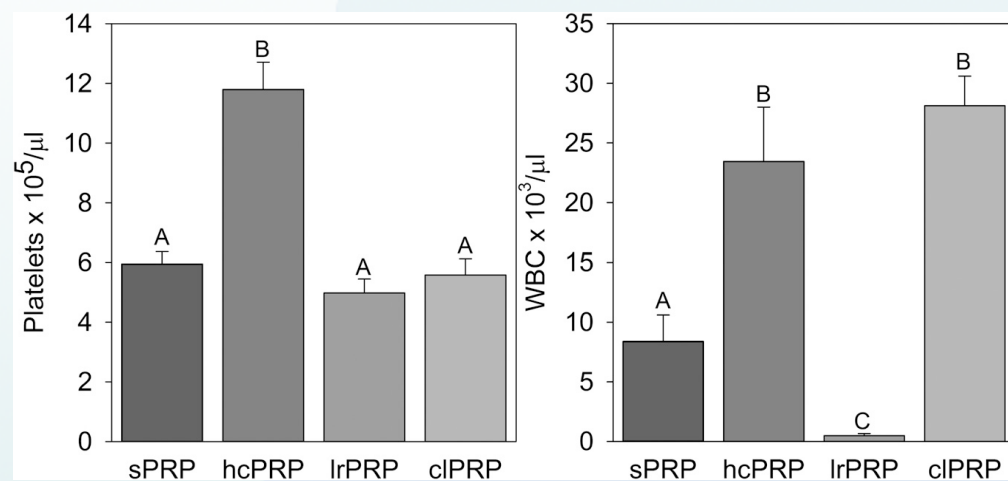
Red or yellow ?



Red PRP ?

Yellow PRP ?

Leucocytes or not?



- Platelet concentration

- $< 10^6$ plaquettes/ μ L (3-4x blood concentration) = optimal (Weibrich et al. 2005, McCarrel et al. 2012, Russell et al. 2013)
- $> 1,2 \times 10^6$ plaquettes/ μ L = inhibition collagen syntheses (Weibrich et al. 2005, McCarrel et al. 2012, Giusti et al. 2014, Boswell et al. 2014)

- Absence of leukocytes

- early inflammatory reaction (Dragoo et al. 2012, McCarrel et al. 2012, Anitua et al. 2014)
- ECM degradation (cytokines et metalloproteinases) (Pizza et al. 2001)
- collagen synthesis inhibition (McCarrel et al. 2012)
- identical antibacterial effect with or without WC (Intravia et al. 2014)

- Absence of erythrocytes

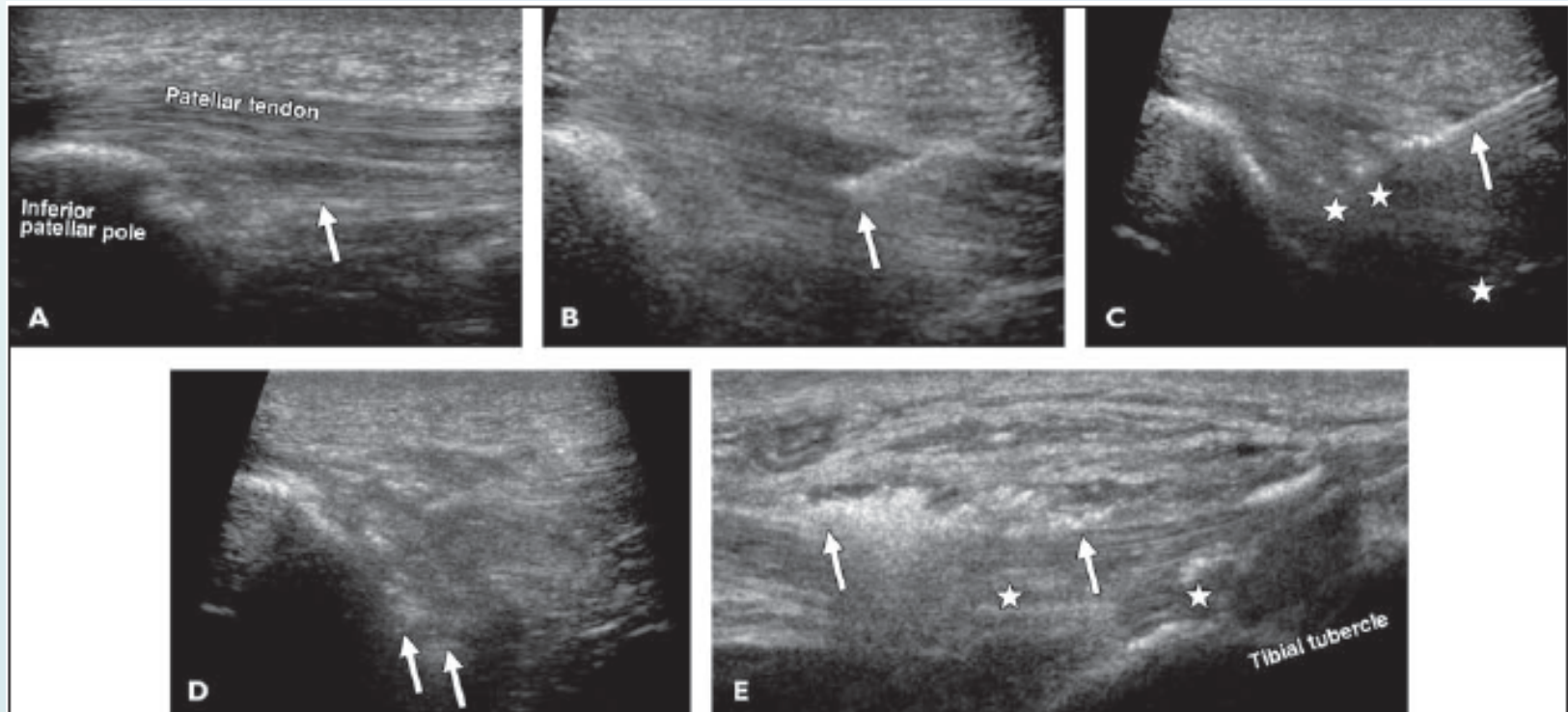
- lysis \rightarrow liberation of free radicals (Jiang et al. 2007)

US guidance or not ?

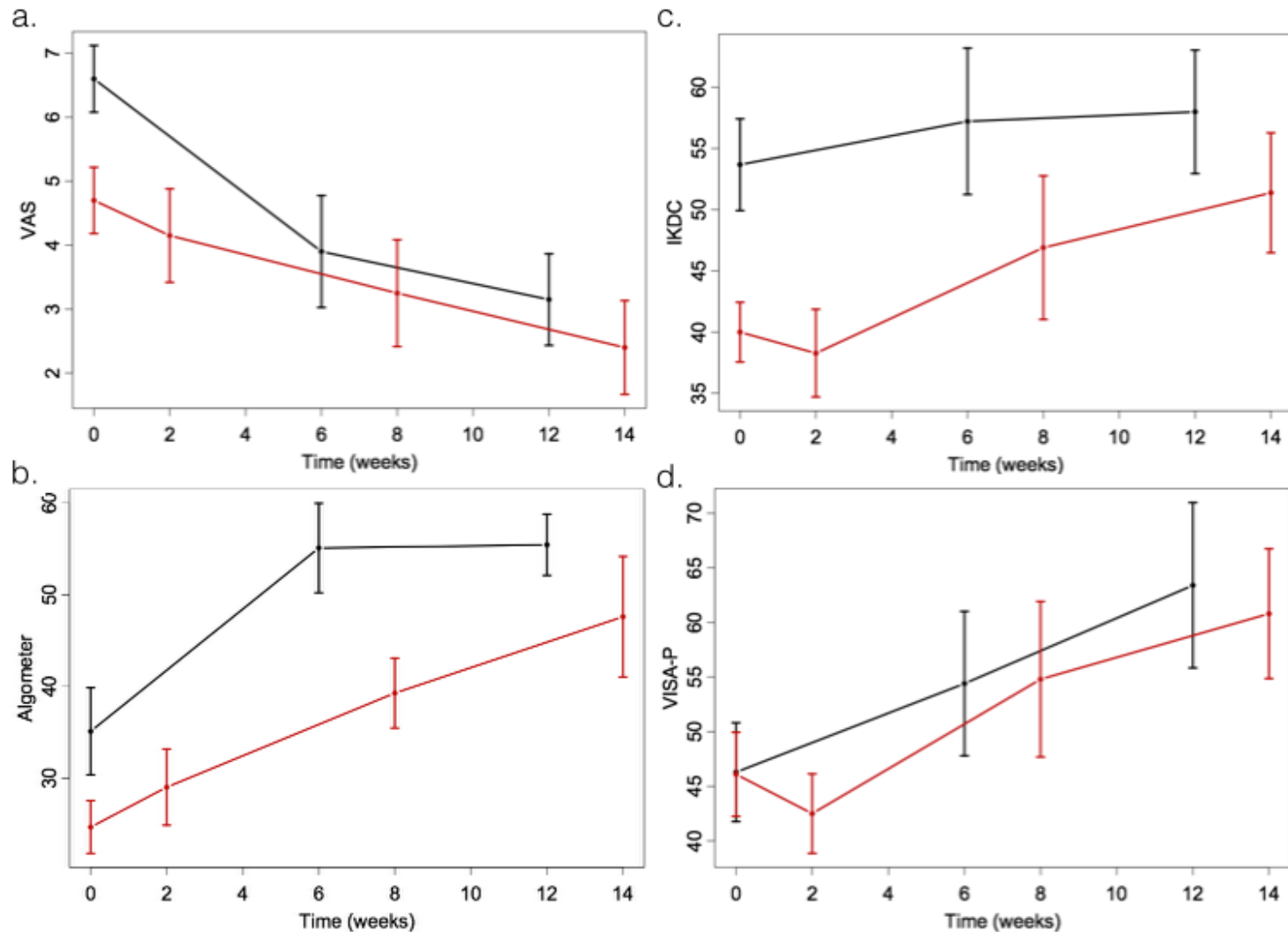
Retrospective Analysis of Postinjection Ultrasound Imaging After Platelet-Rich Plasma or Autologous Blood: Observational Review of Anatomic Distribution of Injected Material

Michael L. Loftus¹
Yoshimi Endo²
Ronald S. Adler³

AJR *American Journal of Roentgenology*
Diagnostic Imaging and Related Sciences



Second infiltration ?

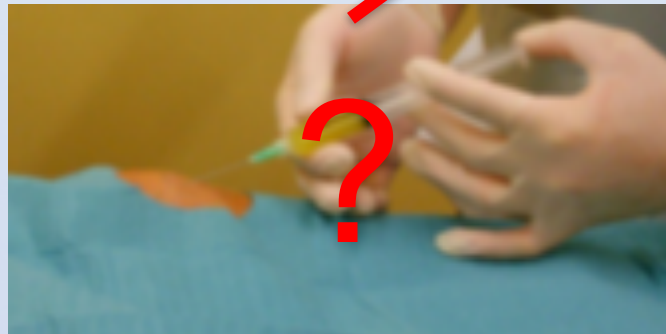
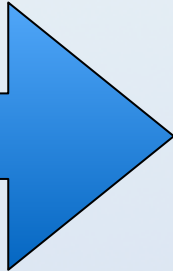


- After painful period —> sub-maximum eccentric rehabilitation + stretching
- Best results if rehabilitation protocol
- Eccentric > concentric (Kaux 2013)
- Reathletisation
- Orthoses or strapping

Conclusions

- PRP seems to be efficient in *chronic tendinopathies*
- PRP remains *controversial*
- Ideal PRP treatment
 - reproducible for all patients
 - poor in leukocytes and erythrocytes (?)
 - platelet activation (?)
 - no local anesthetics nor NSAIDs
 - infiltration US-guided (?)
 - rehabilitation protocol post-infiltration

Conclusion



Merci de votre
attention !

Dank u
voor uw aandacht !



<http://hdl.handle.net/2268/174554>



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