



Arthrex ACP[®] Double Syringe

ACP – Autologous Conditioned Plasma

What?

Autologous conditioned plasma (ACP)



Made of?

Autologous blood



What for?

Conservative treatment of osteoarthritis, tendinopathies and soft tissue lesions

ACP – Autologous Conditioned Plasma

Arthrex's PRP Since 2008

PRP – Platelet Rich Plasma

- Increased amount of platelets in blood plasma
- Produced from patient's own blood

ACP



A

Autologous →
body's own

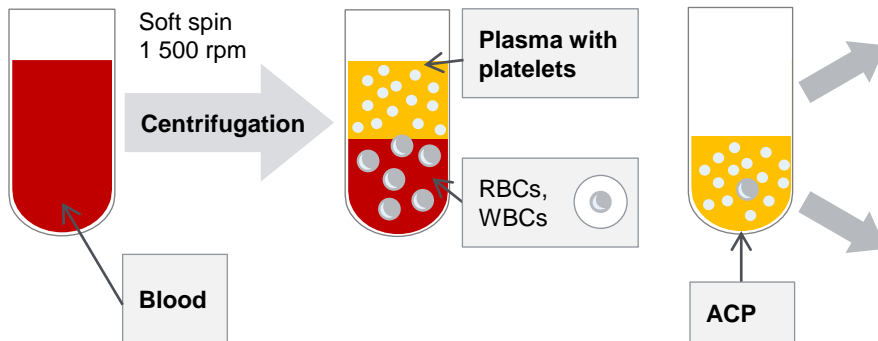
C

Conditioned → separated
and concentrated

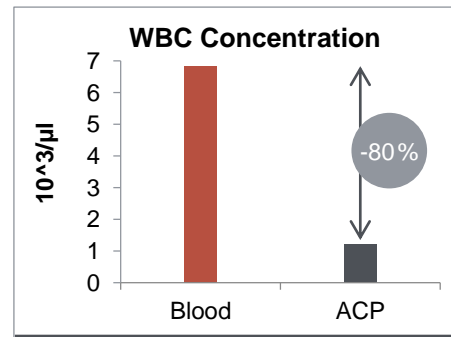
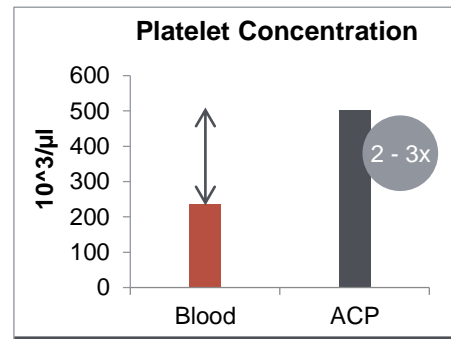
P

Plasma → blood plasma
with its components

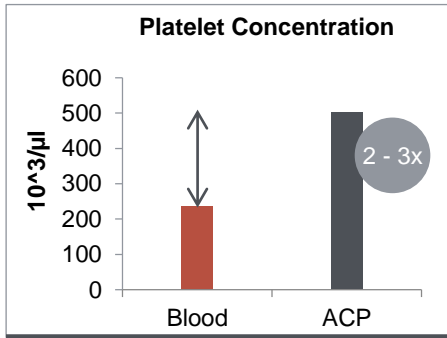
ACP – The Healing Composition



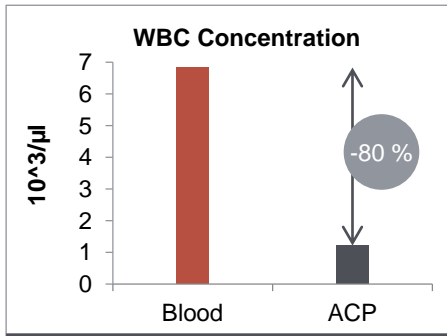
Platelets: thrombocytes
WBCs: white blood cells (leukocytes)
RBCs: red blood cells (erythrocytes)



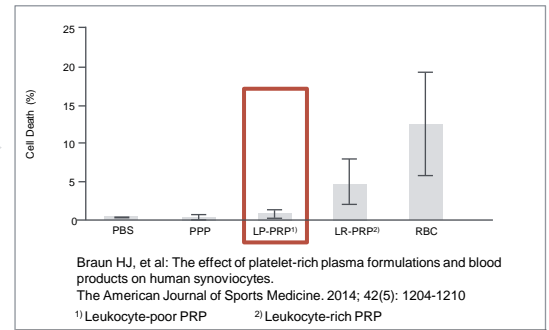
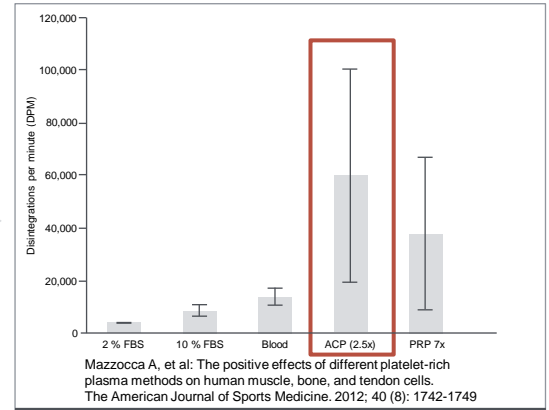
ACP – The Healing Composition



Maximal growth stimulus

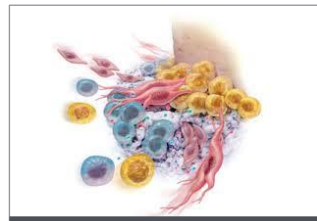
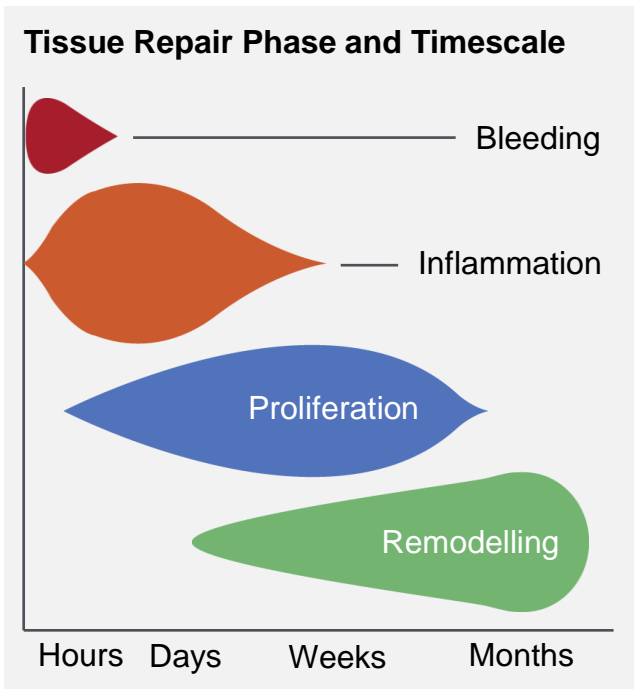


Minimal destructive effect of WBCs



Growth Factors – Active Role in Regeneration

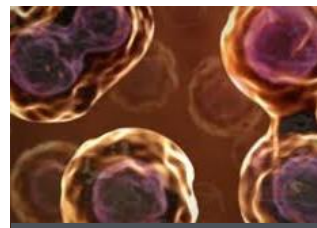
Platelets Release Numerous Growth Factors upon Activation



Chemotaxis



Cell differentiation





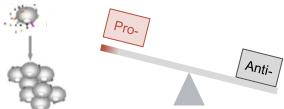
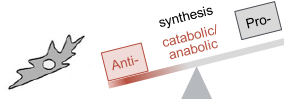
Cell proliferation



Angiogenesis

Growth Factors – Active Role in Regeneration

Complex Healing Cascade Involving Many Players

<p>Inflammation</p>  <p>Neutrophils Macrophages Local cells</p>	<p>Leukocyte traffic, CXCL7, CXCL5, CXCL1, PF4 Macrophage activation PF4, CD40L Termination of inflammation HGF, TGFβ</p>
<p>Angiogenesis</p>  <p>Vascular cells: pericytes, smooth muscle endothelial cells</p>	<p>Pro-angiogenic: VEGF, CXCL12, HGF, angiopoietins, FGF, PDGF, MMP-1, -2, -9, CD40L, EGF Anti-: TIMP1-4, TSP-1, PF-4, angiostatin, endostatin</p>
<p>Migration, proliferation</p> 	<p>Mitogenic factors: PDGF (A, B and C), EGF, IGF-I, II, CTGF, VEGF, HGF, IGFBP3, BMP-2</p> <p>Proteases and fibrinolytic: MMP-1, -2, -4, uPA, PAI-1</p>
<p>Local cells/fibroblasts</p> 	<p>Extracellular matrix Anabolism/catabolism TGFβ, IGF-I, -II, MMPs, ADAMT13, 10,17</p>

- Platelets active in all phases of tissue healing
- Excessively high amounts of leukocytes might promote an undirected tissue destruction
- Recent research suggests that the switch from proinflammatory to prohealing activities is key for efficient repair

Andia I, et al: Molecular and biological aspects of platelet-rich plasma therapies
Oper Tech Orthop. 2012; 22:3-9

Effect

Stimulates Proliferation and Reduces Inflammation

Faster regeneration

Less pain

Improved functionality



Indications

Acute

Tendon Injuries

- Achilles tendon
- Rotator cuff



Ligament Injuries

- ACL
- Medial collateral ligament
- Ankle ligaments



Muscle Tears

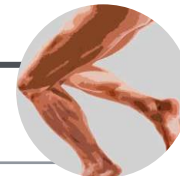
Intra-/Postop

- RC
- Pain reduction after AC decomp.
- Pain reduction after arthroplasty
- MFx (knee, talus)
- BioMatrix CRD™
- Meniscus repair
- ACL (partial or complete)

Chronic

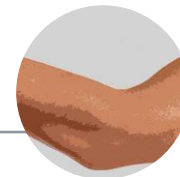
Arthrosis

- I, II, III



Tendinopathies

- Achilles tendon
- Tennis elbow
- Patella tendon
- Plantar fasciitis



Arthrex ACP® Double Syringe – The Genius Idea

Prepare Double Syringe:

1. Tighten the inner syringe (turn it clockwise)
 2. Push the plungers until the stop
-

Ready to go!

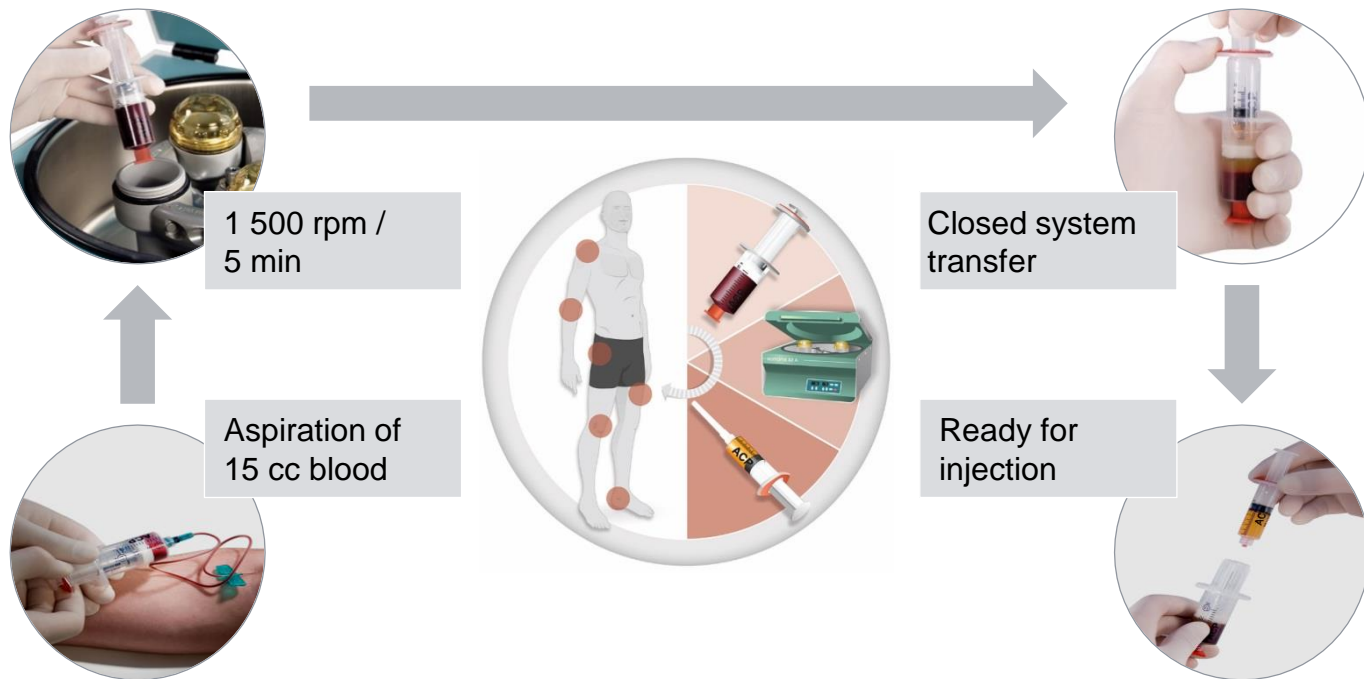
Safe – closed system

Easy – time about 15 min

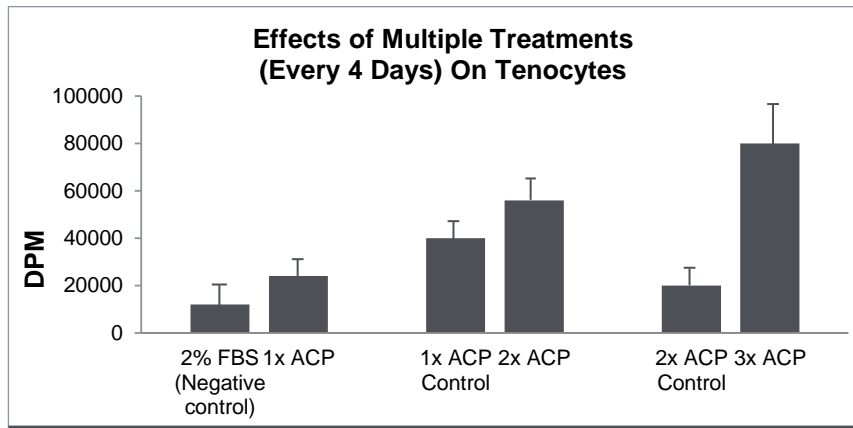
Effective – more than 60 ACP studies



Procedure – Fast, Convenient, Safe



How to Use ACP – Repeated Injections



Mazzocca AD. Biological healing enhancement in shoulder surgery using autologous growth factors. 14th ESSKA Congress 2010, Oslo
DeLong et al., Update on platelet-rich plasma, Current Orthopaedic Practice 2011

Increased Effect with Multiple Injections

Recommendation:

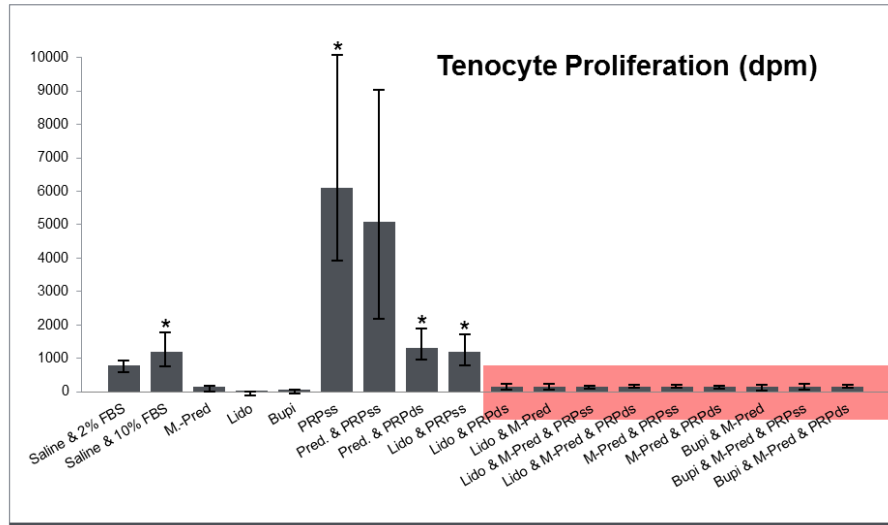
OA, tendinopathies:
3-5 injections with ACP
at weekly intervals

Muscle: up to 5 injections with
ACP every 2-3 days

Zayni et al., MLTJ, 2015: Two consecutive ultrasound-guided intratendinous PRP injections showed a better improvement in their outcomes (patellar tendinopathy) when compared to a single injection

How to Use ACP

Corticosteroids or Local Anesthetics Inhibit Activation of Platelets



Reduction of Cell Proliferation

Recommendation:

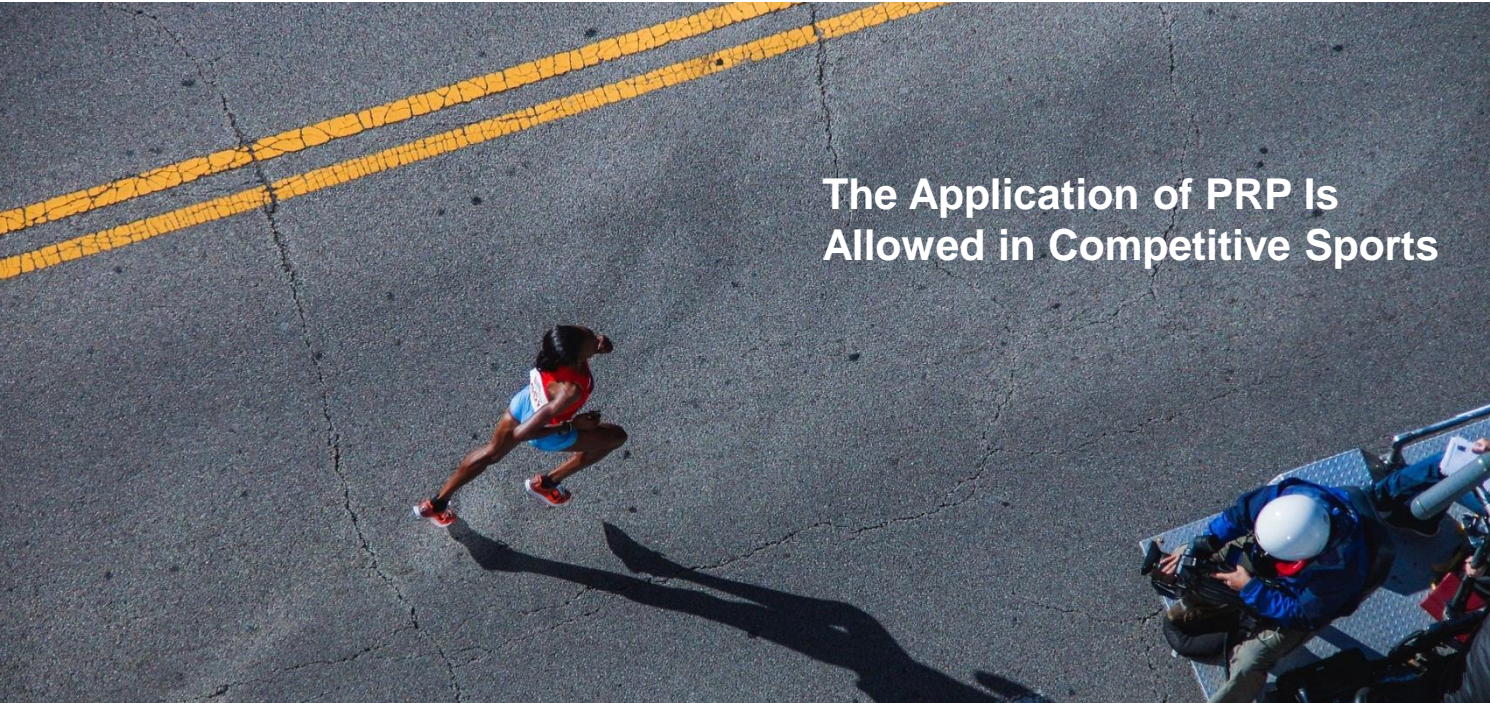
Injection of ACP
without local anesthetics
(alternatively, cooling or
subcutaneous application)

Carofino et al., Corticosteroids and Local Anesthetics Decrease Positive Effects of Platelet-Rich Plasma: An In Vitro Study on Human Tendon Cells, Arthroscopy 2012

ACP for Professional Athletes

WADA Guidelines

The Application of PRP Is
Allowed in Competitive Sports



ACP – Summary

Safe and easy

- Closed system
- 15 min

Autologous

- No anticoagulant
- No separation gel

Evidence

- More than 60 studies demonstrating efficacy for mild to moderate gonarthrosis and certain sports injuries
- Ongoing research activities



Clinical Data

Plasma PRP/ ACP Gonarthrosis

Basic Science

Buil et al, AJSM, 2011

Andia et al,
Op. Tech. Ortho, 2012

Smyth et al,
Arthroscopy, 2013

Anitua et al, J Biomed
Mat.Res, 2014

Braun et al, AJSM, 2014

Sundman et al, AJSM, 2014

Reviews

Filardo et al, KSSTA 2013

Koshbin et al, JARS 2013

Chang et al, ACRM 2013

Pourcho, Osteoarthritis 2014

Kanchanatawan, KSSTA
2015

Meheux, Arthroscopy 2015

Dai et al , Arthroscopy 2016

Shen et al, JOSR 2017

Randomized Controlled Trials

Sanchez et al,
Arthroscopy, 2012 PRGF vs. HA

Vaquerizo et al, Jars, 2013 PRGF vs. HA

Filardo et al,
Musc. Disorders, 2012 PRP vs. HA

Patel et al, AJSM, 2013 PRP vs. Placebo

Cerza et al, AJSM, 2012 ACP vs. HA

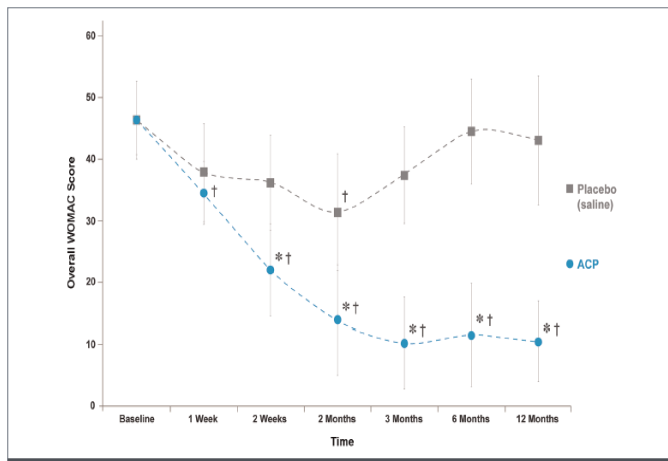
Forogh et al, JSMPPF, 2015 PRP vs. Corticost.

Smith et al, AJSM, 2016 ACP vs. Placebo

Cole et al, AJSM, 2016 ACP vs. HA

OA Knee – ACP

ACP vs. Placebo (Smith, AJSM, 2016)



Results

From week 2 onwards, ACP was **significantly superior to saline placebo** up to 12 months!

ACP group improved their WOMAC scores by 78 % from baseline vs. 7 % for the placebo group

No adverse events

RCT, double-blind, regulated by the FDA, level I

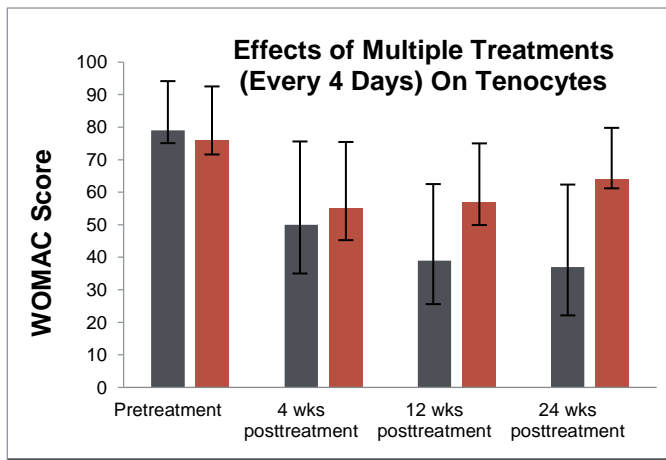
30 patients

3 injections, weekly interval

OA grade II-III; WOMAC

OA Knee – ACP

ACP vs. HA (Cerza, AJSM, 2012)



RCT, level I

120 patients

4 injections, weekly interval

OA grade I-III, WOMAC

Results

ACP showed a **significantly better clinical outcome** than did treatment with HA

Effective up to 6 months (up to 12 months, not published)

Treatment with **HA did not seem to be effective in the patients with grade III gonarthrosis**

OA Review – Kanchanatawan (KSSTA, 2015, Level I)

Conclusion:

This study suggests that **PRP injection is more efficacious than HA injection and placebo** in reducing symptoms, improving function and improving quality of life in patients with mild to moderate OA of the knee who have not responded to conventional treatment and therefore **can be considered as a treatment of choice**.

*Editorial Commentary: The Time Has Come to Try
Intra-articular Platelet-Rich Plasma Injections for
Your Patients With Symptomatic Knee Osteoarthritis*



Timothy J. Hunt, M.D., Associate Editor

Arthroscopy: The Journal of Arthroscopic and Related Surgery, Vol 33, No 3 (March), 2017: pp 671-672

Epicondylitis – ACP

ACP vs. Steroid Betamethasone (Lebiedzinski, SICOT, 2015)

	ACP Group; <i>n</i> =53		Betamethasone Group; <i>n</i> =46	
	Range	Mean	Range	Mean
Before treatment	22.5-94.2	53.2±15.5	27.8-88.7	58.6±14.8
At 6 weeks	2.5-66.7	32.2±18.2	0-68.2	20.6±21.5
At 6 months	0-42.5	14.2±13.4	0-68.8	14.7±22.0
After 1 year	0-66.7	9.9±17.1	73.0	14.4±25.2

Randomized study

99 patients

Single injection

DASH

Results

After 6 weeks and 6 months, mean DASH is significantly better in the steroid group

After 1 year ACP was significantly better

ACP therapy of LE allows better results to be obtained at 12 months, **effect is longer lasting**

Epicondylitis – ACP

ACP vs. Surgery (Ford, HAND, 2015)

Variable	PRP (%)	Surgery (%)	p Value
Pain improvement	89.3	84	0.733
Percent pain reduction	61.1	55	0.566
Associated symptom improvement	85.7	88	0.880
Residual associated symptoms	14.3	10	0.686
Lateral epicondyle tenderness	64.3	44	0.137
Pain with resisted extension	35.7	30	0.431
Full elbow ROM	100	100	–
Return to full activity	82.1	82	0.987
Postop complications	0	0	–
Secondary intervention	7.2	6	0.925

Retrospective comparison

78 patients

Single injection vs. surgical release and decortication

Results

Similar outcomes in pain improvement, symptom improvement and return to work may be achievable with either PRP injections or surgery

ACP offers an additional advantage by reducing risks associated with operative intervention, anesthesia, costs to the patient and shorter recovery time

Patellar Tendinopathy – ACP

Zayni, MLTJ, 2015

Clinical Scores	At Baseline			At 34-Month Mean FU		
	VAS (SD)	Tegner Score (SD)	VISA-P (SD)	VAS (SD)	Tegner Score (SD)	VISA-P (SD)
Group a: 1 PRP injection	7.1 (1.6)	4.1 (1.3)	36.7 (10.6)	3.6 (1.2)	5.9 (5.9)	65.7 (19.8)
Group b: 2 PRP injections	6.7 (1.7)	4.8 (0.94)	35.7 (9.4)	1.07 (1.5)	8.1 (1.7)	93.2 (14)
p value	ns	ns	ns	0.0005	0.0003	<0.0001

Randomized prospect. consec. series, level II

40 athletes

Single vs. two injections (2 weeks apart)

VISA-P, VAS, Tegner

Results

PRP injection **improved clinical outcomes in almost 77 % of patients** and allowed them to return to their presymptom activity level in **86 % of cases**

Two consecutive ultrasound-guided intratendinous PRP injections showed a better improvement in their outcomes when compared to a single injection

Patellar Tendinopathy – ACP

Charousset, AJSM, 2014

Comparison of Clinical Outcomes Before the Procedure and at the 2-Year Follow-Up*

Outcome Measure	Preprocedure	2-Year Follow-Up	p Value
Lysholm score	60 (40-70)	96 (70-100)	<.001
VISA-P score	39 (28-60)	94 (60-100)	<.001
VAS	7 (4-8)	0.8 (0-3)	<.0001

*Values are expressed as mean (range).

Case series, level IV

28 athletes

3 injections, weekly interval

VISA-P, VAS, Lysholm

Results

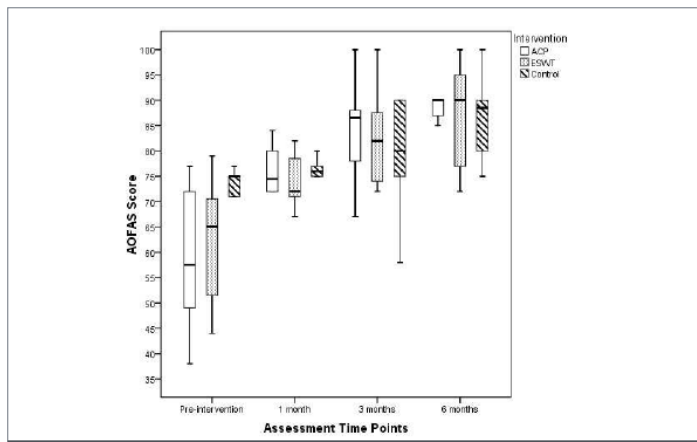
VISA-P, VAS, and Lysholm scores all significantly improved at the two-year follow-up

75 % were able to return to their presymptom sporting level after a mean period of 3 months

Alternative treatment to surgery, which has allowed only 50 % to 70 % of the treated patients (either arthroscopic or open surgery) to return to a presymptom sporting level

Plantar Fasciitis – ACP

Loon Chew, PM&R, 2013



Randomized trial: ACP vs. ESWT vs. conventional

54 patients

Single injection, 2 ESWT sessions (1 week apart)

VAS, AOFAS, 6 months

Results

ACP or ESWT plus conventional treatment significantly better regarding pain and functional outcomes than conventional treatment alone

No significant difference between ACP and ESWT; however, **ACP group demonstrated greater reductions in plantar fascia thickness**

“Our study investigated the use of a single injection only; future trials investigating the optimal number of ACP injections are needed”

Plantar Fasciitis – ACP Martinelli, SICOT, 2013

International Orthopedics (SICOT) (2013) 37:819–842
DOI 10.1007/s00264-012-1741-6

ORIGINAL PAPER

Platelet-rich plasma injections for chronic plantar fasciitis

Niccolò Martinelli · Andrea Martinuzzi · Stefano Carni ·
Ugo Trovato · Alberto Bianchi · Vincenzo Denaro

Received: 14 October 2012 / Accepted: 25 November 2012 / Published online: 19 December 2012
© Springer-Verlag Berlin Heidelberg 2012

Abstract

Purpose The purpose of this study was to assess the safety and preliminary clinical results of platelet-rich plasma (PRP) injections for treating chronic plantar fasciitis.

Methods Fourteen consecutive patients with chronic plantar fasciitis receiving three injections of PRP into the plantar fascia were assessed 12 months after the procedure. The modified Roles and Maudsley score and a visual analogue scale (VAS) for pain were used to evaluate the clinical results.

Results According to criteria of the Roles and Maudsley score, at 12 months of follow-up, results were rated as excellent in nine (64.3 %), good in two (14.3 %), acceptable

knowledge of the pathology has led to the widespread application of a large number of conservative treatments for recalcitrant plantar fasciitis [16], including physiotherapy, plantar-fascia-stretching exercises [8], taping, night splints, prefabricated and custom-made insert, shoe modification, nonsteroidal anti-inflammatory drugs (NSAIDs) and extraosseous shock-wave therapy (ESWT) when conventional physical therapy is not effective [23]. Although the effect of ESWT remains controversial, reliable evidence supports the use of this approach for treating chronic plantar fasciitis [12, 18]. However, adverse effects such as pain during treatment, soft-tissue damage (bleeding, hematoma, neurovascular trauma, the

Single center, uncontrolled, prospective study

14 patients

3 injections, weekly interval

Roles and Maudsley Score, VAS; 12 months

Results

4 out of 5 athletic patients returned to the same sport activity within 3 months after the last injection

79 % rated results as excellent and good

VAS decreased significantly from 7.1 to 1.9 at the last follow-up